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TERUI (M.). **Breeding of** *Oscinis oryzella* **Mats.** [*In Japanese.*]—*J. Plant Prot.* **25** no. 11 pp. 817–819, 1 fig. Tokyo, November 1938.

Oscinis oryzella, Mats., is widely distributed in Aomori Prefecture, northern Honshu, where it sometimes causes serious damage to rice [*cf. R.A.E.*, A **20** 542]. The development of the ears in infested plants was delayed 5 days.

YAGO (M.) & FURUGORI (N.). **On two Mites injuring the Pear Tree.** [*In Japanese.*]—*J. Plant Prot.* **25** no. 12 pp. 914–918, 1 pl. Tokyo, December 1938.

Descriptions are given of both sexes of two mites, one of which is considered to be *Tetranychus bituberculatus*, Harvey, observed attacking the leaves of pear in Shizuoka Prefecture [*cf. R.A.E.*, A **26** 53].

NAKAYAMA (S.). **Some Observations on the Breeding of** *Plodia interpunctella* **Hübn.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 1 pp. 8–11. Tokyo, January 1939.

Larvae of *Plodia interpunctella*, Hb., are very injurious to stored rice in southern Korea, where they also bore into soy beans and feed on dried fruits, radishes and other dried vegetables. The larval stage, the duration of which is dependent on temperature, but very little on humidity, averages 43·2 days. In experiments on control, the percentages of larval mortality given by exposure to 130 and 120–130°F. for 5 and 6 hours were 99 and 98–100, respectively. Fumigation with chloropicrin, ½ lb. per 1,000 cu. ft. for 30–40 hours at 24–28°C. [75·2–82·4°F.], killed 84–100 per cent. *Microbracon hebetor*, Say, parasitises large numbers of the larvae from July.

KAWAAI (I.). **On the Relation of the Deformation of Egg-plant to Cotton Mosaic in Okayama Prefecture.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 1 pp. 46–51. Tokyo, January 1939.

Lygus lucorum, Meyer, which feeds on and deforms egg-plants [*Solanum melongena*] in Japan, also causes similar injury to cotton. This Capsid appears on the egg-plant in late June, is abundant in July, and disappears from late August; it is present on cotton in July and August.

HOFFMANN (A.). **Observations sur le genre** *Phloeosinus* **Chapuis (Col. Scolytidae).**—*Bull. Soc. Sci. nat. Seine-et-Oise* (3) **6** fasc. 1–3 pp. 14–16. Versailles, 1938.

Phloeosinus bicolor, Brullé, was observed in branches of *Cupressus macrocarpa* from the department of Basses-Pyrénées. This Scolytid is widely distributed in the valley of the Seine, where it was observed attacking species of *Juniperus*, *Cupressus* and *Thuja*, and *Sequoia gigantea*, in parks and gardens. It causes considerable losses in nurseries.

The larvae tunnelled in all directions in the sapwood, but the maternal galleries were formed parallel to the direction of the branch, and were quite straight, except at the point of insertion of the branches.

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Keys are appended to both sexes of *P. bicolor* and *P. thujae*, Perris, which the author also observed in *Juniperus*, and of the North African species, *P. cedri*, Bris., and *P. prostratus*, Peyer., which have been recorded attacking cedar and *Juniperus*, respectively, in Algeria.

WICKENS (G. M.). **Rosette Disease of Tobacco.**—*Rhod. Agric. J.* **35** no. 11 pp. 842–849, 1 pl., 1 ref. Salisbury [S. Rhodesia]. November 1938.

Further investigations in 1938 on rosette disease of tobacco in Southern Rhodesia confirm the theory that it is due to a virus transmitted by Aphids tentatively identified as *Myzus persicae*, Sulz. [*cf. R.A.E.*, A **26** 377]. Scattered centres of infection probably arise as a result of the migration of infective individuals from wild or garden plants in which the virus overwinters. A localised and an epidemic phase of infection in the field can be distinguished, of which the former, which occurs throughout the tobacco-growing areas, is due to wingless Aphids which spread slowly from centres of infection, and the latter to winged forms, which become more numerous later in the season, with the result that later plantings are more seriously affected than early ones. The most extensive spread due to wingless Aphids was in a heavily infested plot in which the number of infected plants increased from 19 on 24th January to 60 on 15th February. By this time, winged Aphids were common and had infected 17 widely separated plants in other plots. Syrphid larvae were frequently observed feeding on the Aphids, considerably reducing the population and thereby checking the spread of the disease.

Seed-beds and planted fields should be inspected carefully and frequently, and, except when the plants are so nearly mature that little further damage can be done, all those infected should be removed carefully, so that no Aphids are shaken off, and the remainder sprayed with nicotine. If possible, seed beds containing infected plants should be destroyed completely.

EVANS (J. W.). **The Invermay Bug.**—*Tasm. J. Agric.* **9** no. 4 pp. 196–198, 1 fig., 1 ref. Hobart, 1938.

Nysius turneri, Evans [*cf. R.A.E.*, A **25** 256] is probably distributed throughout Tasmania, but reaches economic importance only in the Launceston district, where it is common, usually appearing in January. The adults overwinter under clods of soil and among débris, and females oviposit in early spring. The nymphs moult 5 times and become adult in late December. The adults migrate considerable distances, but the nymphs do not wander far from the food-plant.

It is suggested that the frequent occurrence of this Lygaeid as a pest near Launceston may be due to the comparative dryness of this district during four of the six summer months, between November and April, in only two of which does the precipitation-evaporation ratio exceed 0·5. Throughout the rest of Tasmania, with the exception of the south-eastern area, this ratio exceeds 0·5 during 4–6 of the summer months. Food-plants of economic importance include potatoes and turnips, ripe and ripening fruit, especially peaches, and dahlias. Feeding by the bugs causes wilting and shrivelling of the apical leaves on hot days when the transpiration rate is high. Methods of control are

discussed [*cf. loc. cit.*]. Burning is ineffective, as by the time the plants are sufficiently dry the adults have dispersed. Liberal applications of derris dust drive away the bugs that are already established and give protection for 2–4 days. Permanent elimination of infestation could be attained only by changing the plant association of the principal breeding sites.

KALSHOVEN (L. G. E.). **Boorders in kruidnagelboomen.** [Borers in Clove Trees.]—*Landbouw* **12** pp. 165–190, 6 figs., 17 refs. Buitenzorg, 1936. (With a Summary in English.)

The chief pests of clove trees (*Eugenia aromatica*) in the Netherlands Indies are Cerambycid borers [*R.A.E.*, A **26** 295]. Old and new records of the occurrence of some of them are given.

In North Celebes, *Hexamitodera semivelutina*, Heller, attacks the trees, whilst small branches have been infested by a species that may be *Coptocercus biguttatus*, Don. The tunnels of *Coloborhombus fasciatipennis*, Waterh., are described; they attain a length of 5–8 ft. and trees are killed by subcortical mines ringing them. A few Scolytids and Platypodids appear to be secondary pests only.

FRANSSEN (C. J. H.). **Een voorlopig beknopt overzicht van de plagen van de mangga.** [A preliminary Survey of the Pests of the Mango Tree.]—*Landbouw* **14** pp. 620–642, 2 pls., 16 refs. Buitenzorg, 1938. (With a Summary in English.)

This survey deals with 23 pests, of which 21 are insects infesting mango in the Netherlands Indies. Brief notes are given on the kinds of injury caused, the biology of the pests, some of which have been already noticed [*R.A.E.*, A **23** 439; **24** 572; **25** 734], and the possibilities of control.

The most important species are the weevil, *Cryptorrhynchus gravis*, F. [*cf.* **24** 198], and the Cerambycid, *Rhytidodera simulans*, White. The eggs of the latter are laid on the branches, and the larvae bore into them and pupate in the mines. Severely attacked parts of the trees die. The egg and larval stages last 9–12 days and 4–6 months, respectively. The pupal stage, together with the resting period of the adult, lasts 1–3 months.

KALSHOVEN (L. G. E.). **De ziekten en plagen van den rasamala.** [The Diseases and Pests of *Altingia excelsa*.]—*Tectona* **30** pp. 162–176, 2 pls. Buitenzorg, 1937.

This is a compilation of existing information on the pests and diseases of *Altingia excelsa*, one of the most valued forest trees in western Java. Thirty different forms of injury, some of which are caused by insects, are recorded according to the parts of the tree affected and the stage of development of the tree at which the attack occurs.

More detailed information is given on the more important pests, including Noctuid larvae and those of the Rutelid, *Anomala* (*Euchlora*) *viridis*, F., in young plantations. A Hepialid ring borer, *Phassus* sp., kills saplings 2–3 years old; and the larvae of the Saturniid, *Cricula trifenestrata*, Helf., and *Eutelia blandiatrix*, Boisd., and the adults of *Anomala viridis* cause defoliation.

PRUTHI (H. S.) & BHATIA (H. L.). **Biology and General Morphology of *Leucopis griseola* Fall. (Chamaemyidae, Diptera), an Important Predator of *Aphis gossypii* and some other Aphid Pests of Crops.**—*Indian J. agric. Sci.* **8** pt. 5 pp. 735–740, 1 pl., 26 refs. Delhi, 1938.

In 1937, larvae of *Leucopis griseola*, Fall., all stages of which are described, were observed preying on *Aphis gossypii*, Glov., on experimental plots of cotton at New Delhi. This appears to be the first record of this fly from India. The distribution of this and other species of the genus is summarised from the literature.

At New Delhi, adults hovering over cotton plants were common during November and December; oviposition took place from 3 to 5 p.m. among colonies of *A. gossypii*, the number of eggs laid on one leaf varying from 1 to 38. A single individual during the larval stage destroyed 70–100 immature Aphids. Other Aphids attacked included *Macrosiphum avenae*, F. (*granarium*, Kby.) and *Myzus persicae*, Sulz.

During December and January, the maximum numbers of eggs laid in the laboratory by a female in 4 weeks and 1 day were 42 and 7, respectively. At average maximum and minimum temperatures of 61–57·7°F., the egg and larval stages lasted 4–7 and 16–21 days, respectively, and at 62·7–57·8°F., the pupal stage lasted 29–49 days. The larvae moulted 3 times and pupated on the lower surface of fallen leaves or about 1 in. below the surface of the soil. The adults lived for 6–8 weeks when fed on sugar solution, and for 2–4 days when kept without food.

[KOZHANCHIKOV (I. V.).] **Кожанчиков (И. В.). Geographical Distribution and physiological Characters of *Pyrausta nubilalis* Hb.** [*In Russian.*]—*Zool. Zh.* **17** no. 2 pp. 246–259, 1 map, 36 refs. Moscow, 1938. (With a Summary in English.)

Laboratory investigations on the influence of temperature, atmospheric humidity and nutrition on the immature stages of *Pyrausta nubilalis*, Hb., were continued in Leningrad [*cf. R.A.E.*, A **26** 475] in order to correlate the geographical distribution of this pest with its physiological characteristics.

The eggs proved to be hygrophilous, all hatching at 100 per cent. relative humidity at temperatures that ranged from 17·5 to 30°C. [63·5–86°F.]. At 32·5, 15 and 12·5°C. [90·5, 59 and 54·5°F.], mortality averaged 7, 20 and 32 per cent., respectively. At 90 per cent. humidity, all the eggs hatched only at 25°C. [77°F.], while at other temperatures between 17·5 and 30°C. mortality varied from 2 to 8 per cent. It was considerably higher at 80 per cent. humidity, but was only 6 per cent. at 25°C. At 75 per cent. humidity, mortality was complete at all temperatures except 25°C., at which it was 17 per cent. At all humidities, the development of the eggs was shortest (3 days) at 30°C. The thermal limits for embryonic development were 9–10 and 35°C. [48·2–50 and 95°F.]. There was no diapause; the eggs either developed within a certain period or died.

First-instar larvae feed on the surface of the leaves of their food-plants, but after the first moult the larvae bore into the stems, within which they eventually pupate; this penetration into the stems is probably due to the instinctive tendency of the larvae to seek a greater humidity. Individuals in the first

instar developed most quickly and mortality among them was lowest at 100 per cent. relative humidity, whereas a decrease of humidity to 95 per cent. markedly retarded development and increased the rate of mortality; at that humidity no larvae survived at temperatures of 27·5°C. [81·5°F.] and above. The average length of the larval stage, from hatching until the suspension of feeding, was least (12·8 days) at 32·4°C. [90·32°F.] and mortality was lowest (29 per cent.) at 29·3°C. [84·74°F.].

The average duration of the prepupal stage varied from one day at 32·4 and 34°C. [93·2°F.] to five days at 22·6°C. [72·68°F.]; in some individuals it lasted only a few hours. No diapause occurred at 34–26·1°C. [93·2–78·98°F.], but of the prepupae kept at 24 and 22·6°C. [75·2 and 72·68°F.], 74 and 90 per cent., respectively, diapaused, and all did so at 18·5 and 14°C. [65·3 and 57·2°F.]. The diapause in prepupae kept at a comparatively low temperature was of very long duration and was not affected when they were placed at optimum temperatures. The diapause ceased and pupation took place at 25°C. only after the prepupae had remained at a temperature of 0°C. [32°F.] for several months. After a diapause of three months at 0°C., only 20 per cent. of the prepupae pupated, but all did so after remaining at 0°C. for six months. These observations showed that temperature is of primary importance for the development of the larval and prepupal stages of *P. nubilalis*; one or more generations in the year were obtained, depending on temperature and irrespective of whether the strains originated from southern Ukraine or from northern Ukraine, where, as a rule, only one generation occurs in a year.

In pupae kept at 100 per cent. humidity, mortality was lowest (20 per cent.) at 20–30°C. Development was quickest (about 7 days) at 30 and 32·5°C., but mortality reached 25 per cent. at 32·5°. All pupae died at 35°C., and 84 per cent. did so at 12·5°C. Observations on pupae resulting from prepupae collected in the field in dry regions in southern Ukraine and in the forest-steppe zone in northern Ukraine showed that the duration of development is not much affected by variations in humidity, but that mortality is greater under conditions of dryness; it was lowest (20 per cent.) at 100 per cent. humidity, and was still only 60 per cent. at 25.

Further work on the food preferences of first-instar larvae showed that, in addition to the results already published [*loc. cit.*], no mortality occurred on birch or on hemp and maize. It was only 3 and 7 per cent. on elm and alder, respectively, while on *Poa pratensis* and oak it was 10 per cent. No inherited food preferences were shown by larvae of strains of *P. nubilalis* from hemp and maize in northern districts and in southern Ukraine, respectively. Individuals of either strain were reared on both food-plants, the percentages of mortality in the northern strain being practically equal.

The geographical distribution of the pest, which is briefly summarised from the literature, is closely connected with its physiological characteristics. It prefers humid biotopes both in Eurasia and North America, regions having in the period June–August a mean temperature above 20°C. [68°F.] and 200–300 mm. precipitation being particularly favourable. Mass propagation takes place, however, only in limited and widely separated territories, namely, the eastern United States and the adjoining parts of southern Canada, central and south-eastern Europe and south-eastern Asia. The northern limits of its occurrence are determined by the sum of warm temperatures

in the summer necessary for the completion of one generation, the low winter temperatures being less important owing to the high degree of cold-resistance of the hibernating prepupae. Only one generation is produced in northern regions, whereas two or more occur in central Europe, the northern Caucasus, the Russian Far East and the eastern United States.

MÜLLER (Klothilde). **Histologische Untersuchungen über den Entwicklungsbeginn bei einem Kleinschmetterling** (*Plodia interpunctella*). [Histological Investigations on the Beginning of Development in *P. interpunctella*.]—*Z. wiss. Zool.* (A) **151** pp. 192–242, 35 figs., 3 pp. refs. Leipzig, 1938.

This study of embryonic development in *Plodia interpunctella*, Hb., contains some observations on its bionomics, recorded during breeding experiments in the laboratory, in which the larvae were fed on a mixture of dried nuts and figs. Although conditions were optimal (20–23°C. [68–73·4°F.] and 45–60 per cent. relative humidity) there was high larval mortality and much deformation of the adults in the second and third generations, indicating insufficient climatic adaptation. At room temperature, development from egg to adult averaged 53–56 days, this period being shortened to 35–40 days in the third generation. The process of pairing is described; the total number of eggs deposited per female was 250–300 [*cf. R.A.E.*, A **26** 460].

ESCHERICH (K.). **Die phytophagen *Megastigmus*-Arten (Chalcididae) als Zerstörer von Nadelholzsamen.** [The phytophagous Species of *Megastigmus* as Destroyers of the Seeds of Conifers.]—*Z. angew. Ent.* **25** pt. 3 pp. 363–380, 11 figs., 34 refs. Berlin, 1938.

A list is given of Torymids of the genus *Megastigmus* recorded as destroying the seeds of conifers, together with a key to the seven species of importance in Germany, accompanied by brief notes on their morphology and on the conifers concerned [*cf. R.A.E.*, A **19** 127]. Adults of these species are present from March to August, according to region and climate. Females appear later than males and oviposit in fertilised flowers and young cones. Usually one larva develops in each seed, completely destroying its contents. They hibernate in the hollowed-out seeds, and either pupate in the following spring or diapause for a further year. Records in the literature show that females of *Megastigmus abietis*, Seitn., survive for up to 59 days, and that 50 per cent. of the seeds in spruce cones may be infested by the larvae.

Species imported in seed can prove very injurious, an instance being *M. spermotrophus*, Wachtl, introduced into Germany from North America in seeds of Douglas fir [*Pseudotsuga taxifolia*].

Measures suggested in the literature include exposure of the seed in winter for 5–15 minutes to 51–54°C. [123·8–129·2°F.] to kill the larvae, fumigation of the seed with carbon bisulphide, or keeping the seed in gauze-covered jars at a moderately warm temperature, so that the adults emerge.

Hofmann (C.). **Versuche mit einem neuen Kontaktgift gegen Forstschädlinge.** [Experiments with a new Contact Poison against Forest Pests.]—*Z. angew. Ent.* **25** pt. 3 pp. 381–396, 5 figs., 1 col. pl., 26 refs. Berlin, 1938.

An account is given of successful experiments in Germany with a new proprietary contact dust insecticide of unspecified composition against larvae of the nun moth, *Lymantria monacha*, L., and the pine Geometrid, *Bupalus piniarius*, L. This product is free from the disadvantages of dinitro-o-cresol, for it appears to be non-poisonous to warm-blooded animals, not particularly harmful to bees, and practically non-injurious to vegetation. The early instars of *L. monacha* were especially sensitive to it.

Gösswald (K.). **Ueber den Vorgang und die Folgen des Puppensammelns bei der roten Waldameise *Formica rufa* L. und Vorschläge zum Schutz dieses nützlichen Raubinsekts.** [On the Practice and Results of Collection of the Pupae of the red Forest Ant, *F. rufa*, and Suggestions for the Protection of this useful predacious Insect.]—*Z. angew. Ent.* **25** pt. 3 pp. 397–418, 6 figs., 4 refs. Berlin, 1938.

Formica rufa, L., is highly beneficial in forests in Germany [*cf. R.A.E.*, A **23** 8], but is decreasing owing to collection of the pupae for medicinal and other purposes. The effects on the ant population of the collection of pupae are discussed, and proposals are made for regulated collection and for the protection and encouragement of this useful ant [**23** 64].

Böttcher (F. K.). **Untersuchungen über den Einfluss von Pflanzenschutzmitteln auf die Bienen. III. Teil : Die Wirkung von Pyrethrum auf die Bienen.** [Investigations on the Effect on Bees of Materials used in Plant Protection Work. Part III. The Action of Pyrethrum on Bees.]—*Z. angew. Ent.* **25** pt. 3 pp. 419–441, 2 graphs, 16 refs. Berlin, 1938.

The following is based on the summary of this account of investigations on the effect on honey bees of pyrethrum (Pyrethrin I + Pyrethrin II) : Pyrethrum is a powerful stomach poison, the action of which is greatly influenced by temperature. At 20°C. [68°F.], the minimum lethal dose of total pyrethrins varies from 0·03 to 0·27 mmg., whereas at 34·5°C. [94·1°F.], which is the temperature that prevails inside a hive, it is 0·27–3·3 mmg. As a contact poison, pyrethrum is also much influenced by temperature. In a spray with the addition of 0·15 per cent. soft soap as a wetter, the minimum lethal concentration at 20°C. lay between 0·0002 and 0·003 per cent. total pyrethrins, and at 34·5°C. it was between 0·0002 and 0·008 per cent. In small-scale cage experiments in which bees on flowers were dusted or sprayed with pyrethrum, some died, but bees in the hive and their brood were unaffected. In practice, pyrethrum sprays or dusts are dangerous only during the 24 hours following application. The repellent effect of the usual pyrethrum sprays is so great that bees always refuse them in favour of water. In large-scale field experiments, dusting and spraying normal amounts at normal strengths of 0·2–0·009 per cent. pyrethrins caused only slight losses of no practical importance.

Nowicki (S.). **Ueber einige in** *Diprion* (*Lophyrus*) **schmarotzende Pteromaliden (Hym. Chalc.).** [Some Pteromalids parasitising *Diprion*.]—*Z. angew. Ent.* **25** pt. 3 pp. 472–477, 6 figs. Berlin, 1938.

A description is given of the female of *Dirhicnus magnicornis*, Thoms., an example of which was bred from a cocoon of *Diprion* in Poland in 1937. *Eutelus subfumatus*, Ratz., was obtained from *Diprion pini*, L., in Poland in 1928.

Wardziński (K.). **Der Einfluss der Einzelhaft sowie der schwachen Vergesellschaftung auf die Entwicklung und das Wachstum der Raupen von** *Pieris brassicae* **L.** [The Influence of solitary Confinement and of uncrowded Association on the Development and Growth of the Larvae of *P. brassicae*.]—*Z. angew. Ent.* **25** pt. 3 pp. 478–486, 13 refs. Berlin, 1938.

An account is given of experiments in which first-instar larvae of *Pieris brassicae*, L., were kept singly and in lots of 2, 4, 8, 16 and 32, and given abundant food. The rate of larval development increased with an increase in numbers, possibly owing to the rise in temperature produced. The heaviest pupae resulted from associations of 2 or 4 larvae.

Wiesmann (R.). *Psylla costalis* **Flor., ein neuer Blattsauger an unseren Apfelbäumen.** [*P. costalis*, a new Leaf Sucker of Apple in Switzerland.]—*Schweiz. Z. Obst- u. Weinb.* **47** nos. 15–16 pp. 291–294, 311–314, 3 figs., 1938. (Abstr. in *Neuheiten PflSch.* **31** pt. 6 p. 261. Vienna, 1938.)

The adults of *Psylla costalis*, Flor, suck the leaves of apple trees in Switzerland until the first autumn frosts cause them to seek winter quarters in cracks, mainly in the bark or in posts, etc. Both sexes hibernate. The eggs are laid among the hairs on the leaf stems or the lower surface of the leaves, up to about 4 weeks after blossom time. The nymphs appear up to mid-June, moult 5 times, and become adult in mid-July. The characters differentiating *P. costalis* from *P. mali*, Schm., are given. As *P. mali* is entirely destroyed by spraying in winter with a tar distillate, any nymphs found on sprayed trees in spring and summer are those of *P. costalis*. *P. costalis* does not attack the blossoms, whereas *P. mali* injures both flower-buds and blossoms. Control of *P. costalis* is given by a nicotine spray.

Kaven (G.). **Die Kirschblütenmotte.** [*Argyresthia ephippella*, F.]—*Obst* **7** pt. 4 p. 80. Vienna, 1938. (Abstr. in *Neuheiten PflSch.* **31** pt. 6 pp. 261–262. Vienna, 1938.)

In Austria, the overwintering eggs of *Argyresthia ephippella*, F., females of which oviposit from June to September under the bark scales of cherry, can be destroyed by several applications of a tar distillate of the fruit-tree carbolineum type, sprayed with a powerful jet under the bark scales, the last application being made 1–2 weeks before the buds open. The moths can be killed by a poison bait containing 2 parts barium chloride (or 0·6 part sodium fluoride) and 4 parts molasses in 100 parts water, which should be applied immediately after the cherry harvest as a mist-spray to both surfaces of the leaves.

Doeksen (J.). **Kwade koppen van het vlas** (*Linum usitatissimum* **Linné), veroorzacht door** *Thrips lini* **Ladureau.** [" Bad Heads " of Flax caused by *T. lini*.]—*Tijdschr. PlZiekt.* **44** pt. 1 pp. 1–44, 15 figs., 1 pl., 41 refs. Wageningen, 1938. (With a Summary in English.)

A description is given of the injury known as " kwade koppen," or bad heads, that is caused to flax (*Linum usitatissimum*) in Holland by the feeding of *Thrips lini*, Lad., of which *T. linarius*, Uz., is considered a synonym.

Records of the occurrence of Thysanoptera on flax in Holland are reviewed from the literature and from observations by growers. Descriptions are given of the adults of *T. lini* and *T. angusticeps*, Uz., which is occasionally found on flax, but appears to be a pest of peas, together with characters distinguishing them.

T. lini feeds only on flax and has one generation a year. The newly emerged adults leave the ground about mid-May, and the females migrate to plots where flax is growing, leaving the males. As the males are few in number, it is assumed that parthenogenesis is the rule ; most of the parthenogenetic progeny is female. The females shelter between the young top leaves of flax and feed there. When grown in soils of poor tilth, or next to fields where flax has been grown in the preceding year, infested plants remain short and the set of seed is very poor. The tissue in the flax heads is poisoned by the introduction of enzymes, and, in general, the result is a marked cell division. Later on, the insects feed in these damaged places.

To prevent infestation by *T. lini*, flax should not be cultivated in fields with poor soil. Abundant manuring with potash increases the resistance of the plants, and if flax is to be grown near a field in which it was present in the preceding year, a 6 ft. strip of flax should be planted between the two plots, followed by a strip of oats or wheat. At the end of May, the thrips should be killed by spraying the flax strip with petrol. Whole districts may be protected in this way. Experiments in spraying flax with ordinary insecticides failed owing to waxy secretions of the plants, in spite of the use of spreaders, but such direct control, even in the most favourable case, destroys only a part of the insect population and the reduction is insufficient to obviate the risk of infestation.

Injury by *T. angusticeps* to peas sown after flax can be prevented by sowing strips of flax between the peas.

Ovinge (A.). **De bestrijding van kwade koppen in vlas.** [The Control of " Bad Heads " in Flax.]—*Tijdschr. PlZiekt.* **44** pt. 6 pp. 297–304, 2 pls. Wageningen, 1938.

Experiments were carried out in Holland in May 1938 to ascertain whether spraying with nicotine or derris would control *Thrips* [*lini*, Lad.] infesting flax, and what effect a protective strip has on the infestation [see preceding abstract]. Three tests were made, using derris (5 per cent. rotenone) at the rate of 4 lb. per 100 gals. water, and nicotine at 0·1–0·15 per cent. ; 1 per cent. soap was the spreader for both insecticides, and 2–3 applications were made. Infestation was equally severe in unsprayed fields and in fields sprayed with water. The flax was in much better condition in the fields sprayed with nicotine, but as a strength of more than 0·1 per cent. proved

necessary, one of 0·15–0·2 per cent. is recommended for further work. The fields sprayed with derris were in the best condition, and the flax in them was longer than in those treated with nicotine. Derris acted more slowly, but its effect was more lasting, so that applications could be made at longer intervals. The cost of the treatment was considerable, but was justified by the increase in the crop and in the amount of seed obtained. Satisfactory control was not given either by spraying the edges of fields only, or by the use of protective strips.

Doeksen (J.). **Iets over de bestrijding van** *Thrips lini* **(Ladureau) Doeksen, met derris sproeimiddelen.** [A Note on the Control of *T. lini* with Derris Sprays.]—*Tijdschr. PlZiekt.* **44** pt. 6 pp. 305–306. Wageningen, 1938.

On biological grounds, the author doubted the value of insecticides against *Thrips lini*, Lad., attacking flax in Holland, and as experiments have shown the value of derris [see preceding abstract], he suggests that a possible explanation is an after-effect of derris, and that this in turn may be explained by the translocation of derris, as observed in bean plants [*R.A.E.*, A **26** 332].

Canzanelli (A.). **Contributo alla embriologia e biologia del tarlo del tabacco (*Lasioderma serricorne* Fabricius).** [A Contribution to the Embryology and Biology of the Tobacco Beetle, *L. serricorne*.]—*Boll. Lab. Zool. agrar. Bachic. Milano* **4** fasc. 2 pp. 81–116, 3 pls., 48 refs. Milan, 1935.

This paper comprises an account of laboratory investigations in Milan on the life-history and control of the Anobiid, *Lasioderma serricorne*, F., in stored tobacco, together with descriptions of all stages and of the process of embryonic development. The author's experiments were carried out at temperatures that averaged 18°C. [64·4°F.] from October to March, with a minimum of 15°C. [59°F.] in January, 22°C. [71·6°F.] in spring, and 25°C. [77°F.] in summer, with a maximum of 30°C. [86°F.] in early August. Winter was passed in the larval stage. The larvae began to pupate in early April, the pupal stage averaged 20 days, and the adults paired two days after emergence. Females deposited an average of 25 eggs, which hatched in 8–10 days. Though there was only one generation a year, the hibernating larvae were not all of the same age, so that in some cases pupation and adult emergence occurred very late. All stages were present from May to October.

The larvae moult 4 times, and before pupating, they remained motionless for a time and ceased to feed. Female pupae are larger than male ones. The pupal period lasted 11–20 days from April to August and 20–24 days in September and October. The adults were attracted to light and were active in full daylight. Both sexes survived for 20–45 days, but did not feed. From 3 to 13 per cent. of the eggs laid by fertilised females failed to hatch, possibly owing to lack of humidity or to a sudden drop in temperature. The optimum for the whole life-cycle was 32°C. [89·6°F.], with greater tolerance for temperatures below than for those above. The optimum relative humidity was 75 per cent., death occurring below 30 and at 100. The eggs were laid on or in various forms of tobacco, flour, bread and macaroni products, but larvae placed with whole grains of wheat

all died of starvation in 7–15 days. The greatest injury was caused to tobacco. Of unworked tobaccos, Turkish and Levantine varieties, being sweeter and finer, were preferred. Cigarettes were preferred to cigars, especially fermented cigars.

Work in various parts of the world on the control of *L. serricorne* is reviewed. In the laboratory at 75–80 per cent. relative humidity, adults, larvae and pupae exposed to 60°C. [140°F.] died in 15, 8–10, and 3–4⅝ minutes, respectively. At 50°C. [122°F.], they were considerably more resistant. Of eggs exposed for 2 and 5 minutes to 60°C., 70 and 100 per cent., respectively, failed to hatch. It is concluded that, owing to the delicate nature of tobacco, great difficulties attend the use of any insecticide against *L. serricorne*. In factories, losses can be reduced to a minimum by the systematic destruction of all infested tobacco, careful sealing and periodical fumigation of the rooms, and frequent examination of the tobacco.

Candioli (P.). **Pere invernali e attacchi di** *Cydia*. [Winter Varieties of Pear and Attack by *Cydia molesta*.]—*Note Fruttic.* **17** no. 1 pp. 11–16. Pistoia, 1939.

Infestation by *Cydia molesta*, Busck, of winter pears in the peach growing districts of Verona has been kept in recent years at the low level of 2–10 per cent. as a result of spraying with arsenicals against *C. pomonella*, L. The first applications are made when the adults of *C. pomonella* begin to emerge, and at least two are made in August, when *C. molesta* begins to attack pear. In one orchard, winter pears were sprayed 5 times with 0·3–0·4 per cent. lead arsenate and 0·5 per cent. soap in water or Bordeaux mixture, and in another, 6 or 7 applications were made of a 0·4 per cent. suspension of lead arsenate containing an adhesive.

Goux (L.). **Etude morphologique et biologique de deux Margarodidae (Hem.) nouveaux.**—*Bull. Soc. Hist. nat. Afr. N.* **29** no. 6–7 pp. 466–475, 16 figs., 7 refs. Algiers, 1938.

Descriptions are given of the females and various immature stages of *Kuwania rubra*, sp. n., observed on *Quercus ilex* in Provence and Corsica in 1935, 1936 and 1937, and of *Margarodes buxtoni crithmi*, subsp. n., taken in 1934 at Marseilles on roots of *Crithmum maritimum*. The male of the latter is also described.

K. rubra, which probably occurs throughout the western basin of the Mediterranean, has one generation a year. Females oviposit in June or July, and hexapod larvae give rise to apodal larvae that occur in crevices in branches throughout the year. Characters are given distinguishing this Coccid from *K. quercus*, Kuw., in Japan and *K. betulae*, Borkhs., in Russia.

The eggs of *M. b. crithmi* hatch soon after they are laid, and the first-instar larvae remain in the ovisac during the winter, emerging from the beginning of March. They wander for a time before attaching themselves and moulting. From the beginning of August, they give rise to active hexapod larvae. The males pass through a pupal stage, lasting a few days, before becoming adults, but the females probably omit this stage.

Breny (R.). **Détermination de la vitalité des oeufs de puceron dans l'étude du pouvoir ovicide des produits insecticides.**—*Bull. Inst. agron. Gembloux* **7** no. 3 pp. 276–281, 4 figs. Gembloux, 1938.

A description is given of a method of studying the action of ovicides by means of the microscopic examination of the contents of treated eggs at different stages of development. The contents of healthy eggs of *Aphis pomi*, DeG., at different stages and of dead eggs are described, and a table is given showing the effects (coagulation or dissociation) of heat, lack of oxygen or various poisons. The toxic action of an insecticide may be immediate or delayed, and depends on the degree of development of the eggs as well as on the concentration used.

Salaman (R. N.). **The Fight against Potato Disease.**—*J. Minist. Agric.* **45** no. 9 pp. 881–889. London, 1938.

The two most destructive virus diseases of potato in Great Britain, leaf roll and leaf drop streak, are transmitted by the Aphid, *Myzus persicae*, Sulz.

Measures for control consist in removing foci of infection, destroying solanaceous weeds (among which *Solanum nigrum* may be infected with leaf roll and *S. dulcamara* with other viruses) and weak or diseased potato plants, using uninfected seed or varieties immune from infection, and controlling the vector. A brief account is given of the bionomics of the Aphid [*cf. R.A.E.*, A **22** 386; **23** 492; **24** 61, 551; etc.].

If possible, potatoes should be grown where there are few Aphids [*cf.* **25** 389] in districts in which Aphids are numerous, potatoes should not be planted near market gardens or fruit trees. If peach or apricot trees are near, they should be sprayed in winter to kill the sexual forms and the eggs, and in spring, with nicotine, to kill the winged forms. Cruciferous weeds and potatoes left in the ground from the previous crop should be removed.

Hey (G. L.). **Two new Winter Washes for Fruit Trees.**—*J. Minist. Agric.* **45** no. 9 pp. 932–940, 10 refs. London, 1938.

In an attempt to obtain a wash that would kill all common pests overwintering on fruit trees, and that could be applied much later than tar-petroleum washes, large-scale experiments were carried out, mostly on apple, but also on plums and black currants, in southern England during 1937–1938 with a synthetic organic thiocyanate, β-butoxy-β^1-thiocyanodiethylether, and with 3 : 5-dinitro-ortho-cresol [*cf. R.A.E.*, A **14** 514], both incorporated in petroleum oil and mixed with water to give concentrations of 1 in 800 thiocyanate and 5 per cent. oil in the first case, and of 7 per cent. in the second.

The only scorching was caused by the thiocyanate wash when it was applied to apples after the green-bud stage and to black currants when the flower trusses were showing.

The following is taken from the author's summary : The thiocyanate wash, applied to apples in the green tip and the delayed dormant stages, gave good control of Aphids, Capsid [*Plesiocoris rugicollis*, Fall.] and woolly aphis [*Eriosoma lanigerum*, Hsm.], and also reduced infestation by larvae of the winter moth [*Operophtera brumata*, L.] and Tortricids (chiefly *Tortrix* (*Cacoecia*) *podana*, Scop.), without causing damage to the trees. It gave better control of *E. lanigerum* than a miscible tar-oil wash (but was slightly less effective against other

Aphids) and better control of *P. rugicollis* than either a miscible tar-oil wash or a miscible petroleum-oil wash. The thiocyanate in a non-oil base gave good control of Aphids, excluding *E. lanigerum*, but had little effect on the other pests. Both miscible and emulsion types of petroleum-oil sprays gave some control of Aphids and Lepidopterous larvae, but toxicity was greatly increased by the addition of thiocyanate.

In most cases the dinitro-ortho-cresol wash was effective against Aphid eggs, being slightly superior to the thiocyanate wash and in no way inferior to one of tar-oil, and in some it gave better results than a petroleum-oil wash against larvae of *O. brumata* and *T. podana*. It was somewhat less effective than the thiocyanate wash against *P. rugicollis*.

The results on plums and black currants were inconclusive.

Hunter (L.). **Domestic Pests. What they are and how to remove them.**—Demy 8vo xii+235 pp., 116 figs., many refs. London, John Bale, Sons & Curnow, Ltd., 1938. Price 7*s.* 6*d.*

In this book, an attempt has been made to give essential information on household pests, both plant and animal, that directly affect the health of man or contaminate or destroy food, clothes and furniture. The first part contains general remarks on such points as the nature and importance of domestic pests (most of which are Arthropods), the knowledge necessary for their successful control, and the mechanical, physical and chemical means that may be used to accomplish this end. In the second part, brief descriptions are given of each pest and its bionomics, together with notes on simple methods for its control and a list of references.

Lopez Cristóbal (U.). **Dos nuevos auxiliares de la fruticultura argentina,** *Cremastus flaviventris—Cremastus rubeo*—**n. spp.** [Two new Auxiliaries of Argentine Fruit-growing, *Cremastus flaviventris* and *C. rubeo*, spp. n.]—*Bol. Lab. Zool. Fac. Agron. Univ. La Plata* no. 4, 5 pp. La Plata, 30th November 1938.

Descriptions are given of both sexes of the Ichneumonids, *Cremastus flaviventris*, sp. n., and *C. rubeo*, sp. n., bred from larvae of *Cydia molesta*, Busck, on peach in La Plata, Argentina, in the course of work on the biological control of this pest [*cf. R.A.E.*, A **24** 638]. Their biology was similar to that of *C. flavo-orbitalis*, Cam. [*cf.* **23** 245].

In the laboratory, the adults of both species paired on the day of emergence. Unfertilised females lived for up to 25 days and gave rise to only a few, weak males. Males lived for up to 20 days, and fertilised females up to 45, ovipositing from the third day onward. Females of *C. flaviventris* and *C. rubeo* deposited daily averages of 3 and 5 eggs, respectively, the total numbers deposited being 26 and 31. The egg was laid in the abdomen of an unparasitised larva ; in only one instance in nature was a host parasitised by two larvae, and both of these were *Cremastus*. The parasite moulted four times in ten days, and the host survived for nine days. When full-fed, the parasite left the dead host, spun a slight cocoon and pupated in the mine made by the host, the pupal stage lasting 8–10 days. The complete cycle required a maximum of 21 days. Many individuals of the last summer generation (April and May) remained in the hibernating larvae of

C. molesta ; others completed the larval stage before the hosts hibernated and remained in their cocoons in the twigs or fruit.

The laboratory technique for breeding *Cremastus* was as follows : Adults were placed in breeding cages containing sand, which was moistened daily, and a small jar kept filled with a mixture of apple juice, honey and water. On the 6th day, twigs of peach infested with larvae of *C. molesta* and smeared with the honey mixture were introduced into the cage, which was then covered with a dark cloth. The twigs were withdrawn after 3–4 hours and kept in cages containing pieces of unripe apple or quince and corrugated cardboard, in which the larvae of *C. molesta* pupated. Cards containing cocoons were transferred daily to other cages or tubes, and kept until the adults of *Cremastus* emerged.

In a supplementary note, it is stated that *Dibrachys cavus*, Wlk. (*boucheanus* Ratz.) was observed parasitising pupae of *Galleria mellonella*, L., infesting beehives, this being apparently the first record of this Pteromalid in Argentina. It was bred and distributed.

SCHULTZ (E. F.). **Una nueva plaga en los naranjales tucumanos : la " Cochinilla del Delta "** (*Mesolecanium deltae*, **Lizer**). [A new Pest in the Orange Plantations of Tucumán : *M. deltae*.]—*Circ. Estac. exp. agric. Tucumán* no. 66, 7 pp., 2 figs. Tucumán, 1938.

In October 1938, *Mesolecanium deltae*, Lizer, which infests *Citrus* in the Paraná delta, Argentina [*cf. R.A.E.*, A **22** 49] was observed on orange in the province of Tucumán. In the delta, where there are two generations a year, the first-generation larvae appear in the second half of November, but in Tucumán they are a month earlier, owing to the warmer climate. A brief description is given of the scales, beneath which 400–900 eggs have been observed. It is feared that owing to the absence of natural enemies in Tucumán, this scale may become a serious pest, unless measures are taken for its eradication. The control measure recommended is two applications of a suitable oil emulsion in November, with an interval of 20 days.

DA FONSECA (J. P.) & MORAE (C.). **Processos de criação, disseminação e colonização da " Vespa de Uganda."** [Methods for Breeding, Disseminating and Establishing the Uganda Parasite.]—*O Biologico* **4** nos. 9–11 pp. 285–291, 325–334, 368–376, 23 figs. S. Paulo, 1938.

For the guidance of coffee growers in São Paulo, Brazil, instructions are given for controlling the coffee berry borer, *Stephanoderes* [*hampei*, Ferr.] by means of its Bethylid parasite [*Prorops nasuta*, Wtstn.]. The rearing boxes have already been described [*R.A.E.*, A **25** 787].

EDWARDS (W. H.). **Report of the Entomologist for the Year 1937.**—*Rep. Dep. Agric. Jamaica 1937* pp. 55–58. Kingston, 1938.

During 1937, sugar-cane in Jamaica was attacked by *Aphis sacchari*, Zehnt., in one district, after heavy and prolonged rains in October, and by *Lachnosterna* and *Metamasius sericeus*, Ol., in other areas. Continued observations on the comparative incidence of *Diatraea saccharalis*, F., on varieties of cane [*cf. R.A.E.*, A **26** 490] showed that nodal infestation was highest (10·89 per cent.) in F.C. 916.

In order to establish the predator, *Plaesius javanus*, Er., which was imported from Fiji for the control of *Cosmopolites sordidus*, Germ.,

on banana [*cf.* **26** 212], suckers were collected in areas free from Panama disease and planted closely in a severely infested field, in which the adult predators were later liberated.

Citrus was severely damaged in some districts by *Prepodes vittatus*, L., and *P. similis*, Dru., var. *amabilis*, Waterh. Field counts showed that 25 per cent. of the eggs, which occur in batches of 60–100 between pairs of leaves, were parasitised by *Tetrastichus haitiensis*, Gah. This Eulophid can easily be bred from egg-masses of *Prepodes* collected in the groves, and constitutes an easy additional method of control. Newly hatched larvae of *Prepodes* were attacked by ants, and older ones by the predacious larvae of *Pyrophorus luminosus*, Ill.

Dusting with sodium fluosilicate gave effective control of *Herse cingulata*, F. [*cf.* **26** 145], *Chirida signifera*, Hbst., and *Metriona flavolineata*, Latr., on sweet potato, whereas dusting with calcium chloroacetate injured the foliage. Larvae of *Ligyrus tumulosus*, Burm., and *Lachnosterna jamaicensis*, Arr., infested the roots, and *Chlorida festiva*, L., and *Estola attenuata*, Fisher, the stems of egg-plant [*Solanum melongena*], which was also attacked by *Epitrix parvula*, F., and *Solenopsis geminata*, F. *Corythuca gossypii*, F., caused severe injury to *Cajanus indicus*, and it was also common on egg-plant and *Hibiscus* spp. Other injurious insects recorded include *Apate monacha*, F., *Asterolecanium palmae*, Ckll., and *Xyleborus perforans*, Woll., on coconut, *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) on cabbage and *Phthia picta*, Dru., on tomato. A consignment of 700 adults of *Dasyscapus parvipennis*, Gah., was received from Trinidad in August for the control of *Selenothrips rubrocinctus*, Giard, and the parasites were liberated on infested mango trees. They were recovered in small numbers at the end of the year, but it is not yet known whether this Eulophid will control the pest effectively under local conditions.

Destruction of timber by termites [*cf.* **27** 181] has increased considerably during recent years. The most harmful are *Calotermes* (*Cryptotermes*) *brevis*, Wlk., which attacks dry wood, *Heterotermes* (*Leucotermes*) *tenuis*, Hag., which lives in the ground, and *Eutermes* (*Nasutitermes*) *ripperti*, Ramb., which forms its nests on trees or posts and attacks timber kept in conditions of moisture. The reasons for the increase of *Calotermes brevis* and *H. tenuis* include the scarcity of native hardwoods and the consequent use of imported soft woods, the lack of precautions to prevent the pest from reaching hidden recesses, and the large number of newly erected buildings, which, being close together, encourage the spread of *C. brevis*. The large numbers of *E. ripperti* in the older urban districts are due to the rebuilding of wooden structures without the thorough clearing of old wood from the site, as well as to the use of susceptible timber instead of native hardwoods for buildings and for closely spaced fence posts. A list is given of wood-boring insects, other than termites, that were observed during the investigations, showing the types of wood in which they were found.

Bottel (A. E.). *Celerio lineata* (**Fabr.**). **Common Name—White-lined or Striped Morning Sphinx.**—*Bull. Dep. Agric. Calif.* **27** no. 4 pp. 441–442. Sacramento, Calif., 1938.

Large numbers of migrating larvae of *Celerio lineata*, F., observed in a valley in California in April 1935 were caught in ditches containing

trap-holes. The larvae had destroyed all vegetation in their path. This is apparently the first record of serious damage by this Sphingid proceeding in army formation.

SCHROCK (M.). **Control of Bean Thrips in Stanislaus County.**—*Bull. Dep. Agric. Calif.* **27** no. 4 pp. 468–469. Sacramento, Calif., 1938.

Prior to 1933, beans in an irrigated area in California were severely infested by *Hercothrips* (*Heliothrips*) *fasciatus*, Perg. As methods of chemical control gave unsatisfactory results, a programme of weed eradication was carried out [*cf. R.A.E.*, A **26** 19, 129]. The destruction, in early spring, of the wild food-plants on which *H. fasciatus* overwinters, particularly *Lactuca scariola* and *Sonchus* spp., resulted in a good crop before the thrips again became numerous.

PARKER (J. R.), WALTON (W. R.) & SHOTWELL (R. L.). **How to control Grasshoppers in Cereal and Forage Crops.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1691 (revd.) 16 pp., 12 figs. Washington, D.C., 1938.

This bulletin is a revision of one already noticed [*R.A.E.*, A **20** 430]. Various poisoned baits containing sawdust [*cf.* **23** 235] are recommended, most of which do not contain any molasses or other strong smelling substance, the addition of which is considered unnecessary if flour or bran is included. Liquid sodium arsenite is considered the cheapest and most satisfactory poison.

REED (L. B.). **Advantages of Statistical Methods for the Practical Entomologist.**—*Florida Ent.* **21** no. 3 pp. 33–38, 8 refs. Gainesville, Fla., 1938.

The use of a modern statistical method in which data from small experiments may be analysed and judged on their own merits by means of ordinary arithmetic is recommended to entomologists in place of methods that involve the use of large samples and give inaccurate results with data obtained from limited observations. Allowance must be made for variations arising from numerous conditions over which there is no possible control; unless recognised methods of analysis are used, different conclusions may be drawn by different observers from the same set of data. The method of analysis of variance, developed by R. A. Fisher, enables precise evaluations to be made and also demonstrates the degree of precision with which the experiment was conducted. A brief description of the method is given; an understanding of the underlying theory is not necessary for practical use.

Methods of technique may be tested by statistical methods, which have also made possible the design of more efficient and comprehensive experiments. The type of analysis appropriate for any data depends on the form of the experiment producing them; the requirements for standard methods of analysis are enumerated. The randomised block, Latin square and factorial design methods are described and to some extent compared.

Chisholm (R. D.) & Goodhue (L. D.). **Derris. Effects of Sunlight and Rain on Derris Deposits as Studied in the Laboratory.**—*Soap* **14** no. 12 pp. 117–119, 131. New York, N.Y., 1938.

In view of the fact that derris, which has been shown to be an effective repellent for the Japanese beetle [*Popillia japonica*, Newm.] in the United States, is easily washed by rain from sprayed foliage and decomposed by the action of sunlight [*cf. R.A.E.*, A **25** 41], preliminary investigations were begun in 1934 to devise laboratory methods of measuring the effect on derris deposits of these agents. The spray used in the tests contained 3 lb. derris and 3 lb. resin residue emulsion [**24** 727] in 100 U.S. gals. water.

The following is based on the authors' summary: The derris sprays were applied by means of a commercial paint gun, at 25 lb. pressure, to vertical glass plates measuring 5 × 7 ins. When the plates had been passed through the spray 3 times and the excess spray had been allowed to run off, the deposits were similar to those on foliage sprayed in the field.

The effect of rain was simulated by passing the plates through a spray of water at 8 lb. pressure, produced by two irrigation nozzles 24 ins. from the plates. When plates containing the deposit had been passed through the water spray five times, rather less than 50 per cent. of the derris remained, and this amount of washing was selected as a basis for comparing the effects of rain on the various derris deposits.

The effect of sunlight was studied by exposing the deposits on glass plates either to sunlight or to a mercury-vapour arc, and determining the percentages of derris undecomposed. The effects of the exposure of the plates, over an aluminium reflector, to a mercury-vapour arc for 8 and 16 hours at 30–35°C. [86–95°F.], and at a distance of 15 ins. from the arc, were equivalent to those resulting from exposure on a rack in the open for 5 and 10 days, respectively, when there were 9 hours of sunlight per day.

Woke (P. A.). **The biological Disposition of Rotenone after Ingestion by the Southern Armyworm.**—*J. agric. Res.* **57** no. 9 pp. 707–712, 10 refs. Washington, D.C., 1938.

The following is based on the author's summary: Experiments were made to determine the biological disposition of rotenone after ingestion by the southern armyworm, *Xylomyges* (*Prodenia*) *eridania*, Cram. Sixth-instar larvae that had been reared on turnip plants and cut lettuce were used. Rotenone was fed to the larvae in leaf-sandwiches, and after intervals of time, acetone extracts of the tissues, gut contents, and faeces were prepared and tested against mosquito larvae for the determination of toxicity. Suitable controls were employed.

The results show that the larva of the armyworm, after ingesting 5 mg. rotenone, eliminates all or most of it with its faeces. This result was substantiated by chemical tests.

The toxicity of finely powdered rotenone to mosquito larvae was not altered to a demonstrable extent after 18 hours' incubation in the dark at 29°C. [84·2°F.] with the various tissues or with the contents of the digestive tract.

Couch (J. N.). **The Genus** *Septobasidium*.—Super Roy 8vo, ix+480 pp., frontis., 114 pls., 60 figs. Chapel Hill, N.C., Univ. N. Carolina Press, 1938. Price $5.00.

This monograph comprises a comprehensive study of fungi of the genus *Septobasidium*, all the species of which are found on living plants in association with Coccids. In discussing the relation of these fungi to insects, the author points out that all the species that he has studied cause damage to their host plants, but that this is due not to the fungus directly, but to the continued effect of the presence of fungus and scale insects. The nature of the damage is reviewed and control measures suggested. Although the author enumerates approximately 170 species, some of which are new, he believes these to be but a small proportion of those that exist in nature, as with the exception of the south-eastern United States, no thorough search for them has been made in any region of the world. An extensive bibliography is given.

Curl (L. F.). **Pink Bollworm Control in Southeastern States.**—*J. econ. Ent.* **31** no. 6 pp. 652–656. Menasha, Wis., 1938.

The three main functions of the Division of Pink Bollworm Control of the United States Department of Agriculture, Bureau of Entomology and Plant Quarantine, namely, inspection to determine the presence of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in new areas, enforcement of Federal quarantines and control or eradication of the pest in areas in which it has become established, are discussed with particular reference to Georgia, Florida and Alabama. Inspection of cultivated cotton in the south-eastern States during the years 1935–37 gave negative results. The position in southern Florida was complicated by the abundant wild cotton, notes on the habits and characteristics of which are given. Progress has been made with its eradication, and clean-up measures have resulted in the reduction to 1·33 per cent. of the infestation of wild cotton, which previously ranged from slight to as much as 40 per cent.

Gaines (J. C.). **Analysis of Data in Plat Designs for Cotton Insect Control.**—*J. econ. Ent.* **31** no. 6 pp. 656–659, 1 ref. Menasha, Wis., 1938.

The simplest experimental methods that give a valid estimate of error are randomised blocks and the Latin square [*R.A.E.*, A **25** 428]. The latter has been successfully used in experiments on the control of pests of cotton in several localities. An untreated control was usually included, as no standard insecticide that could be used for comparison was known, and this may have made the experimental error larger than it would otherwise have been. If it is desired to have control plots in the field and omit them in the analysis of variance, the randomised block design is preferable to the Latin square. Factorial design, which includes all combinations of several sets of treatments is preferable when it is desired to compare treatments and combinations of treatments.

GAINES (R. C.). **Toxicity of ten Arsenical Poisons in Fifth Instar Cotton Leaf Worms.**—*J. econ. Ent.* **31** no. 6 pp. 659–663, 1 fig., 5 refs. Menasha, Wis., 1938.

The modified leaf sandwich method [*R.A.E.*, A **25** 245] with a few slight changes was used to determine the toxicity of 10 arsenical insecticides to fifth-instar larvae of *Alabama argillacea*, Hb. Individual doses were varied by taking the poisoned leaf squares from the larvae after they had consumed approximately the desired amount. After feeding on the poisoned leaf, each larva was fed on unpoisoned cotton leaf daily for 96 hours. Mortality among controls was very low. The median lethal dose (M.L.D.) was determined by plotting the data according to the method of Bliss [**23** 493] with the ordinates as probits of percentage mortality and the abscissae as logarithms of milligrams per gram of body weight. Each regression line was fitted by eye to the points representing the experimental data, and the dosage required to kill 50 per cent. read from the graphs. The chemical analysis and M.L.D. of each poison are given in a table. Mixtures of a calcium arsenate with 7·5 or 10 per cent. Paris green and Paris green alone were 2·8, 6·3 and 25 times as toxic as the same calcium arsenate alone, which had a M.L.D. of 0·25 mg. per gm., while 5 other calcium arsenates and lead arsenate were 1·4, 1·3, 2·1, 1·4, 0·3 and 12·5 times as toxic. There was indication of a rather high correlation between the M.L.D. of the calcium arsenates and the particle size of the samples [**25** 692], the coarsest material being the most toxic.

DUNNAM (E. W.) & CLARK (J. C.). **The Cotton Aphid in Relation to the Pilosity of Cotton Leaves.**—*J. econ. Ent.* **31** no. 6 pp. 663–666, 1 fig., 3 refs. Menasha, Wis., 1938.

Tests were conducted in Mississippi during 1937 on the relation between hairiness of cotton leaves, dusted with calcium arsenate [*cf. R.A.E.*, A **25** 236] and undusted, and infestation by *Aphis gossypii*, Glov. [*cf.* **16** 268]. A variety of cotton with 11·7 times as many hairs on the lower surface of the leaf as another variety had 5·8 times as many Aphids. Where 3 and 7 applications of calcium arsenate had been made on each, there were 3·5 and 3·7 times as many Aphids on the hairy variety as on the smooth. On the hairy variety, 3 and 7 applications of calcium arsenate dust caused the Aphid population to increase to 4·1 and 10·8 times that on the untreated control. For the smooth variety, the corresponding figures were 6·8 and 17·0. The total population was greater under all conditions on the hairy cotton, and the corresponding percentages of parasitism were less. Where 7 applications of poison were made to each type, the number of parasitised Aphids increased to about 28 times that on the respective controls. In a second test, in which moderately hairy cottons were compared, the average numbers of hairs and Aphids on the more hairy were 1·9 and 3·1 times, respectively, those on the less. After 7 applications of calcium arsenate, there was a significant increase in the population of Aphids on each group, but the more hairy had only 1·5 times as many as the less. The percentage of parasitised Aphids was less on the more hairy cotton, though where 7 applications of calcium arsenate had been made, the number of parasitised Aphids increased about 8 times on each type. In the third test, undusted crosses of the same parentage were compared. There were 4·4 times

as many Aphids and 9·2 times as many hairs on the intermediate hairy selection as on the smooth, on which, however, the percentage of parasitised Aphids was greater.

MORELAND (R. W.). **Recent Field Tests of Insecticides for Control of the Cotton Bollworm.**—*J. econ. Ent.* **31** no. 6 pp. 666–668, 2 refs. Menasha, Wis., 1938.

Further tests on the control of *Heliothis armigera*, Hb. (*obsoleta*, F.) on cotton [*cf. R.A.E.*, A **20** 134; **26** 141] were carried out in eastern Texas in 1936 and 1937. The insecticide applied was usually calcium arsenate alone or in combination with Paris green or sulphur. In 1936, the average increase in yield from 5 plots that received 4 or 5 effective applications of calcium arsenate was 459 lb. per acre, and from 4 plots that received 2 or 3 applications, 431 lb. per acre. In 1937, the average increase from 4 plots receiving 3 applications was 326 lb. per acre. The average increase in the two seasons from plots that were treated with calcium arsenate and Paris green was 373 lb. per acre. The increases obtained after treatment with calcium arsenate and sulphur were smaller owing to the reduction in the amount of calcium arsenate applied. The increased yield given by barium fluosilicate in the one experiment in which it was used was greater than that given by calcium arsenate in the same experiment, but not greater than the average increase given by calcium arsenate.

EWING (K. P.) & MCGARR (R. L.). **Sulfur and Calcium Arsenate for the Control of the Cotton Flea Hopper and the Boll Weevil.**—*J. econ. Ent.* **31** no. 6 pp. 669–674. Menasha, Wis., 1938.

During 1937, experiments were carried out in south-eastern Texas with mixtures of sulphur, the standard insecticide for the control of the Capsid, *Psallus seriatus*, Reut., and calcium arsenate, that for the control of *Anthonomus grandis*, Boh., to ascertain whether more economical control could be obtained from combined applications. In field plots, which were each of one acre, sulphur, and calcium arsenate and sulphur (1 : 4, 1 : 2 and 1 : 1), and also Paris green and sulphur (1 : 9 and 3 : 37) and cryolite and sulphur were used against *P. seriatus*, and calcium arsenate, calcium arsenate and sulphur (1 : 4, 1 : 2 and 1 : 1) and Paris green and sulphur (1 : 9) against *A. grandis*. The results with Paris green and sulphur and cryolite and sulphur are not discussed, as these mixtures did not appear very promising for the control of both insects. Infestation records and bloom counts showed that calcium arsenate and sulphur gave slightly better control of *P. seriatus* than sulphur alone, but the difference was not great enough to overcome the experimental error between the plots or consistently improve yield. Each of the calcium arsenate and calcium arsenate and sulphur dusts gave a considerable control of *A. grandis*, the control being more or less proportionate to the amount of calcium arsenate used. The addition of sulphur, when the minimum average amount of calcium arsenate was not below 4·66 lb. per acre per application (1 : 2 and 1 : 1 mixtures) increased fruiting, the production of cotton and net profit over that obtained when calcium arsenate alone was used at the rate of 6·68 lb. The 1 : 4 mixture, which gave an average of 2·54 lb. calcium arsenate per acre, was less effective. The 1 : 2 mixture gave a slightly higher average

yield and greater net profit than the 1 : 1 mixture, but the difference might be accounted for by experimental error. The superiority of production obtained after applications of the 1 : 2 and 1 : 1 mixtures over that obtained after calcium arsenate alone may be explained by better coverage, control of light Capsid infestation and of diseases by sulphur, reduction in infestation by the cotton Aphid [*Aphis gossypii*, Glov.] and increased vigour of the plants.

Two experiments in which small plots were arranged in Latin squares, were carried out on the control of *A. grandis* and *P. seriatus*. In each, 5 insecticides and a control were compared. In the first experiment, in which infestation by *P. seriatus* was high and damage continued over a long period, calcium arsenate and sulphur (1 : 1 and 1 : 2) and Paris green and sulphur (1 : 9) gave significantly better control than sulphur alone, but in the second experiment, in which the infestation was light and quickly reduced, calcium arsenate and sulphur (1 : 2 and 1 : 4) and Paris green and sulphur (1 : 9) gave no better control than sulphur alone. The 1 : 1 and 1 : 2 mixtures of calcium arsenate and sulphur (at the rate of 7·8 and 5·35 lb. calcium arsenate per acre per application, respectively) in the first experiment, and calcium arsenate alone (8·22 lb.) and the 1 : 2 mixture of calcium arsenate and sulphur (5·43 lb. calcium arsenate) in the second were equally effective in controlling *A. grandis* and each gave significant control. The 1 : 4 mixture of calcium arsenate and sulphur (3·2 lb. calcium arsenate), the Paris green mixture and sulphur alone were all less effective. In the first experiment, all mixtures gave significantly better yields than sulphur alone, which did not significantly improve the yield from the control plot. In the second experiment, calcium arsenate gave a significantly higher yield than any of the other insecticides, because it gave better control of the cotton bollworm [*Heliothis armigera*, Hb.], which occurred only in this experiment. The 1 : 2 mixture of calcium arsenate and sulphur gave a significantly higher yield than the 1 : 4 mixture, the Paris green mixture, or sulphur alone.

Gaines (J. C.) & Ewing (K. P.). **The Relation of Wind Currents, as indicated by Balloon Drifts, to Cotton Flea Hopper Dispersal.**— *J. econ. Ent.* **31** no. 6 pp. 674–677, 1 fig. Menasha, Wis., 1938.

Psallus seriatus, Reut., migrates in spring from native food-plants to cotton, and *Croton* is the chief plant on which the overwintering eggs occur [*R.A.E.*, A **21** 655]. In Texas, *Croton* grows most abundantly in the lighter sandy soils, whereas most injury to cotton occurs in the black-land areas, although the flea-hoppers are thought to be incapable of long self-sustained flight. On traps 26 ft. high, having sections covered with adhesive, most of the flea-hoppers caught at periods when dispersal was in progress were taken at a height between 21 and 26 ft. Adults and nymphs were caught on aeroplanes, equipped with special traps, at elevations of 20–2,000 ft. and 20–500 ft., respectively. During the winter of 1933–35, about 10,000 acres of *Croton* were destroyed, and the initial infestation of cotton in the following spring was considerably reduced, but a heavy migration of flea-hoppers from native food-plants at least 20 miles away began in the second week of May. Of 3,334 balloons released between 14th May and 12th June 1937 in areas where *Croton* grows abundantly, 346 were recovered; they had drifted for an average distance of

42·6 miles. Three were recovered from places 375, 330 and 318 miles distant, the average speed at which these distances were covered being 17·9 miles per hour. One balloon drifted 155 miles at an average speed of 29·8 miles per hour, and 12 found on the day of release had drifted an average of 62·4 miles at 13·3 miles per hour. The prevailing direction of drift was to the north and north-east from the light soils across and into the heavy soils. These experiments indicate that adults of *P. seriatus* could easily be carried in a short time on wind currents from infested *Croton* to cotton.

Smith (G. L.), Scales (A. L.) & Gaines (R. C.). **Effectiveness of several Insecticides against three Cotton Insects.**—*J. econ. Ent.* **31** no. 6 pp. 677–682, 1 fig., 7 refs. Menasha, Wis., 1938.

The following is based on the authors' summary of the results of tests of various insecticides as dusts against three pests of cotton in Louisiana in 1937 [*cf. R.A.E.*, A **26** 279]. There were definite correlations between net mortality of *Anthonomus grandis*, Boh., caused by calcium arsenate and the particle size [*cf.* **25** 692], density, water-soluble As_2O_5 by the New York method [**24** 256] and molar ratio CaO/As_2O_5 of the samples, those that were coarse, and had low density, high water-soluble As_2O_5 content and low molar ratio CaO/As_2O_5 giving the best kills. There appeared to be no significant correlations between such properties as angle of slope, loose bulking value at constant weight and constant volume, total As_2O_5, water soluble As_2O_5 by the A.O.A.C. method [**25** 693], and free $Ca(OH)_2$. There appeared to be correlation between water-soluble As_2O_5 by the New York method and mortality of *Alabama argillacea*, Hb. The effectiveness of both calcium arsenate and lead arsenate against *Anthonomus* seemed to vary inversely with the amount of carrier added. There was not a significant difference between the mortality caused by lead arsenate and that caused by two calcium arsenates, but a third calcium arsenate gave a significantly higher kill. Calcium arsenate gave significantly higher net mortalities of *Anthonomus* and *Alabama* than the four cryolites tested. There appeared to be a definite relation between net mortality and the amount of cryolite (Na_3AlF_6) in the various commercial samples of cryolite. In general, the highest percentages caused the highest net mortalities, though none was effective. The four cryolites were also compared with sulphur for the control of *Lygus pratensis*, L., but the mortality effected by all treatments was poor and differences were not significant.

Rainwater (C. F.). **Test of Insecticides for Control of the Boll Weevil, with and without untreated Checks.**—*J. econ. Ent.* **31** no. 6 pp. 682–684. Menasha, Wis., 1938.

During 1937, two experiments were carried out in South Carolina with the object of determining accurately the relative value of various dusts for the control of *Anthonomus grandis*, Boh., on cotton. In the first, calcium arsenate alone was more effective than calcium arsenate with lime (1 : 1 or 1 : 2). There was no significant difference between calcium arsenate alone and with sulphur (1 : 1), or between 36 per cent. cryolite and calcium arsenate with lime (1 : 2), but the cryolite

was inferior to the other three calcium arsenate dusts. Pyrethrum and sulphur (1 : 9) had little if any value. In the second experiment, calcium arsenate, alone, with lime (1 : 1 and 1 : 2) and with sulphur (1 : 1) had a highly significant superiority over barium fluosilicate and talc (1 : 2) which was not significantly better than the untreated control. The criteria used were bloom counts and seasonal infestation, as infestations of Aphids on all plots except those treated with pyrethrum and sulphur and the untreated control made boll counts and records of yield unreliable.

GILMER (P. M.). **A Progress Report on the Control of Boll Weevils on Sea-Island Cotton.**—*J. econ. Ent.* **31** no. 6 pp. 684–687. Menasha, Wis., 1938.

Because of differences in habits of growth and susceptibility, the control of *Anthonomus grandis*, Boh., on sea-island cotton differs considerably from that on upland or short-staple cotton. Only a small proportion of the blooms produced on sea-island cotton develop, and open bolls do not appear until 60–65 days after flowering. The squares may be attacked for 6–10 days, and the bolls, which are equally attractive, never become so tough as to make oviposition impossible [*cf. R.A.E.*, A **14** 533] and are susceptible to attack to within a few days of opening. Squares and bolls must be continuously protected until the bolls are open (a period of 6–8 weeks). The revival of the industry in the old sea-island belt depends on the finding of an economical way of controlling *A. grandis*.

In 1937, experiments were carried out in Georgia and Florida with the equipment available on the farms, namely hand guns for dusting and small traction outfits for spraying. As initial infestation was very light, pre-square applications of calcium arsenate were of no practical value. A relatively heavy population developed during August, particularly where the weevils could migrate from mature upland cotton. A mixture of 1–1½ lb. calcium arsenate, 1 U.S. gal. cane syrup and 1 U.S. gal. water applied with a mop gave good control early in the season and reduced the weevils of the first brood, but failed to protect growing bolls from serious injury after mid-August. Dusting with calcium arsenate and mixtures of calcium arsenate with sulphur or lime after 10 per cent. infestation was reached, and intensive dusting and defoliation after 2·5–5 per cent. infestation to prevent the population from building up, both gave satisfactory control of *A. grandis*, but though yields were somewhat larger on the plots that received the intensive treatment, the profits were less. Both treatments, particularly the intensive one, injured the plants. The increases in yields given by dusts of calcium arsenate with sulphur or lime were not quite so great as those given by the undiluted calcium arsenate. A spray of 5 lb. calcium arsenate, 1 U.S. gal. cane syrup and 49 U.S. gals. water at 25–30 U.S. gals. per acre gave fair protection and a small profit. A 10 : 50 mixture of calcium arsenate and water gave somewhat better control, but it was difficult to keep this amount of calcium arsenate in suspension. The sprays caused rather serious injury to the plants. The soils on which sea-island cotton is grown are seriously deficient in potash and nitrogen. When they were well fertilised, the use of arsenicals did not cause sufficient shedding of leaves to reduce yield.

Stracener (C. L.). **Control of Insect Pests of Milled Rice by improved Storage Bags.**—*J. econ. Ent.* **31** no. 6 pp. 687–688. Menasha, Wis., 1938.

Rice is particularly susceptible to attack by insects after milling. Milling removes all insects in all stages except for occasional eggs of *Calandra* (*Sitophilus*) *oryzae*, L., which are very deeply embedded in the grain, but these are not numerous, and very little damage results if subsequent reinfestation can be prevented. The burlap bags commonly used for storage do not give protection. In experiments in Louisiana, multiwall paper bags gave 80 per cent. better control, but small insects crawled through the holes made in stitching. Heavy gummed paper tape over the stitching gave effective protection from all insects except termites for 10 months, but its use was too costly to be practical. Metal strips to cover the stitches at the bottom and to close the top gave complete protection for the 8 months of greatest insect activity, the only insects to enter the bags being termites, which punctured them. Rice stored in paper bags retains its moisture better and keeps brighter than rice stored in burlap bags. Metal strips should cost little, if any, more than stitching.

Osterberger (B. A.) & Christian (M. B.). **Some new Notes on the Sugarcane Rootstock Weevil, *Anacentrinus subnudus*, Buch.**—*J. econ. Ent.* **31** no. 6 pp. 688–690, 5 refs. Menasha, Wis., 1938.

Anacentrinus subnudus, Buchanan [*R.A.E.*, A **20** 589] has been found throughout the section of Louisiana where sugar-cane is grown, and has been recorded from sugar-cane, maize, *Sorghum* and 10 wild graminaceous plants, of which *Paspalum urvellei* is apparently the preferred food-plant. Weevils were first collected for study from the stubble of sugar-cane, and later by submerging roots of *P. urvellei* in water, on which the adults floated. From 1 to 20 pairs of weevils were placed in cloth-covered cages, one-fourth full of finely sifted soil with a small piece of sugar-cane for food and oviposition. The eggs were transferred to small sterilised boxes containing moist sand covered with paper towelling, on which they were placed, and the larvae, on hatching, were put in cavities made in the rootstock of sugar-cane with a dissecting needle. The inoculated stalks were then replaced in a specially prepared bed. They were taken up at intervals for observation, and the prepupae removed and placed in the type of cage used in the incubation period. On emergence, the adults were placed in pairs in cages for observation. The eggs are deposited singly in small holes and are completely concealed. In eastern Louisiana, they are laid throughout the year, but the rate of oviposition is greater in the warm season. The maximum, minimum and average lengths of the incubation period were 30, 7 and 20·0 days during the period between 1st October 1936 and 1st April 1937, and 16, 4 and 6·3 days between 1st April and 1st September 1937. The newly hatched larvae feed on the rootstock and tunnel into it. The maximum, minimum and average lengths of the larval period between April and September 1937 were 39, 22 and 27 days. As many as 23 full-grown larvae have been found in one piece of rootstock 8 inches long. From May to September 1937, the maximum, minimum and average lengths of the pupal period, which is passed in the rootstock, were 13, 8 and 9·4 days. From May to September 1937, 43 mated pairs of adults were studied. Males lived 18–72 days with an average

of 49 days, and females 15–57 with an average of 45, in which time they laid 11–24 eggs, with an average of 16. In heavily infested sugar-cane fields, weevils were found in débris and soil beneath the plants, apparently their natural habitat, and on the stalks 3–4 inches from the ground, as well as in the rootstocks. They feed on the young shoots and buds and on the rootstock, causing injury that is noticeable, but not so serious as that caused by the larvae. A few adults have been observed to fly in the laboratory, but attempts to catch them on adhesive screens have not been successful.

Wisecup (C. B.) & Reed (L. B.). **A Study on the Decrease in Effectiveness of Cubé when exposed to Weathering.**—*J. econ. Ent.* **31** no. 6 pp. 690–695, 1 ref. Menasha, Wis., 1938.

In tests carried out in Florida in 1937, cubé dusts with various diluents and cubé sprays with different spreading agents and adhesives were applied to cabbages in the field to determine the effect of weathering on their toxicity to larvae of *Pieris rapae*, L. After 1, 3 and 5 days' exposure, the average mortality was 89, 59 and 42 per cent., respectively, while mortality in the controls was 17 per cent. The rate of decrease in toxicity between inspections was practically the same for all materials, none of the inert ingredients used preventing the effects of weathering. Sprays containing adhesives and spreaders gave the highest mortality, and sprays were superior to dusts. There were no significant differences between the kinds of spreaders or diluents used. The spray containing no adhesives or spreaders gave as good kill as the dusts, although only about half as much cubé was applied per acre. Precipitation was second to duration of exposure in causing decreases in effectiveness. There was a significant correlation between the decrease in mortality during the longest periods of exposure and the logarithms of the total rainfall recorded during these periods.

Cockerham (K. L.) & Deen (O. T.). **Laboratory Tests with Insecticides against the Vegetable Weevil.**—*J. econ. Ent.* **31** no. 6 pp. 695–697, 1 ref. Menasha, Wis., 1938.

During 1937, a series of laboratory experiments was carried out to determine the relative effectiveness of various materials as compared with calcium arsenate for the control of the vegetable weevil, *Listroderes obliquus*, Klug. A dust of pyrethrum containing 1·05 per cent. total pyrethrins diluted with an equal amount of China clay caused immediate paralysis of larvae and adults and was as toxic to the larvae as calcium arsenate dust, but much less toxic to adults. These two materials were more toxic to larvae than all the others tested, which, like calcium arsenate, allowed of a little feeding. Undiluted sulphur and a derris and China clay dust containing 2 per cent. rotenone were effective against young larvae, causing 80 and 82·22 per cent. mortality, respectively. A derris and clay mixture containing 1 per cent. rotenone killed 44·44 per cent. of the small larvae. A similar mixture containing 0·5 per cent. rotenone, a derris spray containing 0·025 per cent. rotenone without a spreader or with the addition of a proprietary alkylphenylbenzenesulphonic acid (1 : 600), and a spray containing 2 lb. phenothiazine [thiodiphenylamine] to 50 U.S. gals. water were not effective against the larvae. A bait of sodium fluoride, wheat bran and chopped turnips (1 : 15 : 8) with water to moisten was practically as toxic as calcium arsenate dust against

adults, and one in which crude arsenic was substituted for the sodium fluoride was next in effectiveness. Derris and China clay dusts containing 1 and 2 per cent. rotenone were not effective. In preliminary field experiments by P. K. Harrison in Louisiana, dusts containing 1 per cent. rotenone with equal parts dusting sulphur and tobacco as diluent and derris sprays containing 0·02 per cent. rotenone with or without the spreader (1 : 1000), applied at intervals of 14 days or less, were effective in protecting turnips and mustard from injury by the larvae.

Smith (C. E.) & Brubaker (R. W.). **Observations on Cabbage Worm Populations at Baton Rouge, La.**—*J. econ. Ent.* **31** no. 6 pp. 697–700, 1 ref. Menasha, Wis., 1938.

As the insecticides used in the United States for the control of Lepidopterous larvae on cabbage and other cruciferous vegetables are largely specific in their action, a knowledge of the seasonal abundance of the various species is necessary for the adequate use of control measures. The results of a survey of infestation of cabbage made in Louisiana during 1936 and 1937 are here reported, and the number of plants examined and the average number of larvae of different species found per 100 plants for periods of half a month are given in a table. *Plusia* (*Autographa*) *brassicae*, Riley, *Pieris rapae*, L., and *Plutella maculipennis*, Curt., were the most abundant species, in the order given. *Plusia brassicae* is predominant on autumn crops and appears late on spring crops. *Pieris rapae* is the most important, though not necessarily the most abundant, species in spring, but does not usually appear in injurious numbers on autumn crops until late in the season. *Plutella maculipennis* may become abundant on either spring or autumn crops if they are near a source of infestation, and natural control agents are lacking. It spreads slowly and thrives best in dry, cool weather. *Hellula undalis*, F., *Evergestis rimosalis*, Gn., and several species of Agrotinae, including *Heliothis armigera*, Hb. (*obsoleta*, F.), *Feltia annexa*, Treitschke, and *Agrotis ypsilon*, Hfn., are most abundant on autumn crops.

Wisecup (C. B.). **The relative Insecticidal Effectiveness of some Dusts containing Rotenone.**—*J. econ. Ent.* **31** no. 6 pp. 700–703, 1 ref. Menasha, Wis., 1938.

The following is based on the author's summary: The toxicity of various rotenone-containing dusts to larvae of *Pieris brassicae*, L., was compared in laboratory experiments. For each material tested, 180 uniform quarter-grown and an equal number of half-grown larvae were used. There was no significant difference in average insecticidal efficiency between three samples of *Derris elliptica* and three corresponding samples of cubé (*Lonchocarpus* sp.) containing, respectively, nearly equal percentages of rotenone and total extractives and diluted to contain uniform percentages of rotenone. One sample of cubé, however, was definitely inferior, contrary to what would have been expected from the chemical analyses. Samples of *Tephrosia virginiana* diluted with clay (1 : 3), with resulting rotenone contents as low as 0·042 per cent., were so toxic to quarter-grown larvae that no comparisons could be made. The same dilutions tested on the more resistant half-grown larvae did not differ significantly among themselves, with the exception of a sample ground coarser than 60 mesh,

which was inferior to the best. The best sample of diluted *Tephrosia* (rotenone content 0·097 per cent.) was not inferior to a derris dust containing 0·5 per cent. rotenone, and the next best (rotenone content 0·105 per cent.) was only slightly inferior, both being superior to a derris dust containing 0·1 per cent. rotenone.

MADDEN (A. H.) & CHAMBERLIN (F. S.). **Biological Studies of the Tomato Worm on Tobacco in Florida, 1936 and 1937.**—*J. econ. Ent.* **31** no. 6 pp. 703–706, 4 refs. Menasha, Wis., 1938.

An intensive study on the biology of *Protoparce sexta*, Joh., was made during 1936 and 1937 in Florida, where it is an important pest of tobacco, which seems to be its preferred food-plant in the locality. The heaviest infestations occur on cigar filler tobacco, but the damage done to cigar wrapper tobacco is greater economically, as the slightest injury to the leaves detracts from the value of this crop. Under insectary conditions, the egg, larval and pupal stages lasted 2–8, 14–44 and 18–386 days, but at the end of the 386 days many pupae had not completed the stage, which may last nearly two years. The eggs are laid on the leaves, usually along the outer edges of the lower surface. There are usually 5, but occasionally 6, larval instars. The larvae remain on the under surface of the leaves and feed almost continuously. The adults conceal themselves in wooded areas during the day, and feed, pair and oviposit only at dusk. The generations overlap considerably owing to the variable length of the pupal period. Adults begin to emerge in late April or early May from pupae of all four generations of the previous season, and from pupae that are almost two years old. Adults of this overwintered brood continue to emerge over a considerable period, and some appear simultaneously with first- and even second-generation individuals. Oviposition begins shortly after emergence, and the first larvae probably complete their development about the end of May. The average length of the pupal period at this time of year is about two weeks, so that adults of the first generation begin to emerge during the second half of June, and appear in greatest numbers a few weeks later. Adults of the second generation begin to emerge towards the end of July. The life-cycle of the third generation is longer, the adults emerging at the beginning of September. They lay eggs that give rise to larvae, of which only a few survive to enter the ground and pupate. There is a gradual decrease in emergence from the beginning of July, and no larvae that enter the ground to pupate after the middle of August give rise to adults in the same year. Larvae are most abundant in the field in the second half of July, at the height of the tobacco-growing season.

A number of common birds prey upon the larvae, and moles and skunks destroy some of the pupae. Eggs and larvae are attacked to some extent by *Engytatus geniculatus*, Reut. (*Cyrtopeltis varians*, Dist.), and a spider, *Peucetia viridans*, Hentz, and the larvae by *Polistes metricus*, Say. Certain species of Diptera parasitise the larvae, notably *Sarcophaga lambens*, Wied., and *Sturmia protoparcis*, Tns., which is now the most prevalent. There is little or no parasitism by *Apanteles* [see next two papers]. None of the natural enemies exerts much direct control, as they are mostly active after the tobacco is harvested. A disease caused by *Bacillus sphingidis* is rather prevalent but of little importance in control.

Destroying the tobacco stalks immediately after harvest reduces the number of overwintering pupae, and in experiments carried out over 5 years, autumn ploughing destroyed about half the pupae. Poison baits kill considerable numbers of adults before oviposition [*R.A.E.*, A **21** 245, etc.].

GILMORE (J. U.). **Observations on the Hornworms attacking Tobacco in Tennessee and Kentucky.**—*J. econ. Ent.* **31** no. 6 pp. 706–712, 1 ref. Menasha, Wis., 1938.

The results are given of studies over a period of 20 years, made principally in Tennessee and Kentucky on *Protoparce sexta*, Joh. [see preceding paper] and *P. quinquemaculata*, Haw., on tobacco, of which they are serious pests in all parts of the United States where the crop is grown. All stages of both species are described, and the principal morphological features by which the two species may be distinguished are given. In Tennessee, *P. sexta* was usually more abundant than *P. quinquemaculata* during June and July, but the two species were approximately equally abundant in midsummer and *P. quinquemaculata* predominated in September. The sexes of both species were present in practically equal numbers. The average durations of the egg, larval, prepupal and pupal stages of both species were approximately 4, 22, 4 and 21 days. There were usually 5, and occasionally 6, larval instars. The pupal period was passed in the soil at a depth of 4–7 ins., and hibernation took place in this stage. Of 13,498 larvae of *P. sexta*, 24·3 per cent. gave rise to adults. The average length of the hibernation period was 312·7 days, but a small percentage of pupae hibernated for two years or longer. The five longest hibernation periods averaged 790 days. Under identical conditions, only 4·8 per cent. of 4,468 larvae of *P. quinquemaculata* gave rise to adults. Adults of both species usually emerge over a period of 90 days, beginning in late May. The second generation of each develops principally from eggs laid in late August. The average date of first emergence and the latest date of emergence of the spring generation of *P. sexta* were 5th July and 2nd August.

The moths feed for about two hours after nightfall on many kinds of flowers, including those of Jimson weed (*Datura stramonium*) and *Catalpa*, the preferred ones, and tobacco. During this feeding period, large numbers can be collected. Marked adults of both species were captured as much as half a mile from the point of release, and the maximum distance known to have been covered by a marked individual was $1\frac{1}{4}$ miles. The moths fly freely throughout the night, when the weather is favourable. Pairing usually occurred during the second or third night after emergence, and oviposition began about 4–6 days after emergence, 1–5 eggs usually being laid on one plant. Tobacco and tomato are preferred by both species for oviposition. In captivity, females of *P. sexta* laid an average of about 500 eggs. The first-generation larvae attack half-grown or smaller plants in June, sometimes killing them. In July and August, the valuable leaves are damaged by the second brood. Although a single leaf may provide sufficient food for the development of one individual, the nearly full-grown larvae often damage 4 or 5.

Over 90 per cent. of the pupae can be killed by autumn and winter ploughing. Without such ploughing, about 25 per cent. of the pupae survive. The numbers of both species are further reduced in autumn

by parasites such as *Sturmia* spp., *Winthemia quadripustulata*, F., and *Apanteles congregatus*, Say [see next paper] and by predators. A list of the parasites and predators reared from each species in Tennessee and Kentucky is given. Control is also exercised by drought, a disease, the causal organism of which is *Bacillus sphingidis*, and wild birds, domestic fowls, skunks and moles.

GILMORE (J. U.). **Notes on *Apanteles congregatus* (Say) as a Parasite of Tobacco Hornworms.**—*J. econ. Ent.* **31** no. 6 pp. 712–715, 1 fig. Menasha, Wis., 1938.

Apanteles congregatus, Say, the immature stages of which are described, occurs generally over the eastern United States, and in Canada, Brazil and Jamaica, and parasitises the larvae of certain Sphingids, including *Protoparce sexta*, Joh., the preferred host, *P. quinquemaculata*, Haw., *P. sexta paphus*, Cram., *Dolba hylaeus*, Dru., *Ceratomia catalpae*, Boisd., *Sphinx chersis*, Hb., *S.* (*Hyloicus*) *kalmiae*, S. & A., *Ampeloeca myron*, Cram., *A. versicolor*, Harris, *Atreides plebeja*, F., *Pholus satellitia pandorus*, Hb., *P. achemon*, Dru., and *Sphecodina abboti*, Swains. Eggs are usually laid in the posterior segments of the second- and third-instar larvae of the host, several being deposited during each insertion of the ovipositor. In the case of 1,343 individuals reared to the adult stage in Tennessee from eggs laid by unfertilised females in larvae of *Protoparce sexta*, the period between oviposition and the appearance of the cocoon averaged 9·8 days, and that between the formation of the cocoon and emergence of the adult, 6·9 days. The average number of parasites produced per host was about 112, but in the field it was greater. The average length of life of the host after oviposition by the parasite was 11·2 days under experimental conditions, and about 16 days in the field. It usually continued to feed for a few days during this period and moulted once or twice. *A. congregatus* passes the winter as a larva within its cocoon on the surface of the soil. The adult usually emerges in April, before larvae of *P. sexta* and *P. quinquemaculata* are present, so that another host must be used. With the exception of *P. sexta paphus*, all those recorded above occur in the central sections of Tennessee and Kentucky. After larvae of the two species of *Protoparce* appear, breeding in them is practically continuous until late September. When host and parasite are most abundant, 50 per cent. or more of the host larvae are usually parasitised. Later, parasitism of other Sphingids is resumed.

Under field conditions, heavy parasitism by *A. congregatus* was observed in *P. sexta* and *P. quinquemaculata* on tomato and other plants, but in only one instance was parasitism observed on hosts feeding on dark-fired tobacco. Gross parasitism of larvae of *P. sexta* fed on tomato, *Datura stramonium* and burley tobacco was obtained experimentally, but repeated attempts to obtain parasite cocoons on larvae reared solely upon dark-fired tobacco failed, except in the case of one host larva that produced 7 parasite cocoons. It appears that larvae fed on this tobacco contain a toxic principle, probably nicotine, that prevents maturation of the parasite. The lack of external evidence of parasitism may not be a true measure of the value of the parasite in controlling larvae on this tobacco, as oviposition and partial development occurred, and mortality of the immature parasite resulted in that of the host.

A. congregatus in the cocoon is attacked by 4 species of secondary parasites, of which *Eupteromalus viridescens*, Walsh, *Horismenus floridanus*, Ashm., and *Pleurotropis* sp. were reared in Tennessee and *Hypopteromalus tabacum*, Fitch, was reared by F. S. Chamberlin in Florida.

Shands (W. A.), Poole (R. F.) & Moss (E. G.). **Conditions involved in the severe Losses of newly set Tobacco in North Carolina, 1937.**—*J. econ. Ent.* **31** no. 6 pp. 715–719, 3 figs., 5 refs. Menasha, Wis., 1938.

The following is based on the authors' summary: Losses in stands of newly transplanted tobacco in late May and June 1937 in western and north-central North Carolina were so severe that, after 3–5 replantings over much of the affected area, final stands were below the average, and many acres were ploughed up and the land used for other crops. Although the mortality of plants and the slow rate of growth of those that survived were undoubtedly influenced by a combination of factors, such as feeding by Elaterid and Crambid larvae, the improper application of fertilisers and the size and condition of the plants used in late transplanting, the most important factor appeared to be the feeding of adults of *Epitrix parvula*, F., on the plant tops and of larvae of the same species on the roots, and the tunnelling of the latter in the stems. The tunnels, which began below the surface of the soil, developed spirally and appeared from the outside as slender brownish streaks. They were usually in the cambium layer, but sometimes extended well into and through the stem. Many of the stems of injured plants had developed a soft rot. All the characteristic symptoms of the injury described were obtained in northern North Carolina throughout the summer of 1937, on newly set tobacco on which adults of *E. parvula* had been confined. Apparently such severe injury by this species on newly set tobacco, particularly the tunnelling of the stems by the larvae, had not previously been observed over such a wide area.

Allen (N.). **Some Applications of Mathematics to an Insect Life-history Study.**—*J. econ. Ent.* **31** no. 6 pp. 719–722, 2 figs., 1 ref. Menasha, Wis., 1938.

Studies on the life-history of *Rhopalosiphum pseudobrassicae*, Davis, an important pest of crucifers, were carried out in Louisiana between July 1933 and June 1934. Observations were made daily on females confined individually on young plants in separate containers in an outdoor insectary. The temperatures for each two hours of every female's life were obtained from a hygrothermograph kept in a shelter about 100 yards from the insectary, and all females produced in any one month were grouped together and the average temperatures for the life periods of all of these were averaged to find the monthly temperature used. This and the average periods of growth, reproduction, and life of each group of females are given in a table, with the index number of each obtained by expressing the average for the month as a percentage of the yearly average. The results are compared on a graph. The study illustrates how index numbers are effectively used to reduce data to purely relative values for comparative purposes, and how, when plotted, they indicate the direction and

something of the value of the coefficient of correlation. The rate of growth, the reproductive period and the length of life of females were markedly influenced by temperature. The correlation coefficients between the periods of growth, reproduction and life on the one hand and temperature on the other, the formula for calculating which is given, were —0·8957, —0·8670 and —0·9654, respectively. A diagram is given associating the average temperature with the average length of life for the twelve months.

PIERCE (W. C.). **Control of the Obscure Scale on Pecan with low Concentrations of Lubricating Oil Emulsions.**—*J. econ. Ent.* **31** no. 6 pp. 722–724, 1 ref. Menasha, Wis., 1938.

Experiments were carried out in north-western Louisiana during 1934–37 on the effectiveness of dormant sprays of low concentrations of lubricating oil emulsions for the control of *Chrysomphalus obscurus*, Comst., on pecan [*cf. R.A.E.*, A **22** 181]. About 30 U.S. gals. spray were applied per tree in 1934 and 50 U.S. gals. in the following years, the trees being about 50 ft. high. Sample infested branches were taken from the trees 3–6 months after treatment, and sections were examined for female scales. In 1934 and 1935, dead scales and those that matured and deposited eggs were counted, and in 1936 and 1937, the living females that failed to deposit eggs were counted also. Sprays with an oil concentration of 3 and 4 per cent. gave only 66·9 and 73·5 per cent. control, respectively, in 1934. In the three following years, adequate control (88·5–97·9 per cent.) was obtained with the same concentrations owing to the increased rate of application. Most female scales that survived spraying failed to develop or deposit eggs. Sprays containing 2 per cent. oil effected more than 80 per cent. control by direct kill combined with the prevention of oviposition. This action on the surviving females considerably reduced the difference in effectiveness between sprays containing 2 per cent. oil and those containing 3 per cent., which caused much higher direct kill. Severe injury to the trees resulted in some instances from the application of 4 per cent. sprays, which alone gave consistently high direct kill. A study made in November 1937 of trees sprayed in 1936 and in 1937 indicated that *C. obscurus* can be held in check by spraying every other year with oil emulsions if the control effected is above 90 per cent. Delay in the development of foliage was very noticeable when 1–2 U.S. gals. of oil were applied per tree, and the lower branches on weak trees were sometimes killed. Injury was apparently not affected by the degree of refinement or viscosity of the oil or the method of emulsifying it.

SNAPP (O. I.). **Recent Experiments with Ethylene Dichloride Emulsion for Peach Borer Control.**—*J. econ. Ent.* **31** no. 6 pp. 725–727, 3 refs. Menasha, Wis., 1938.

Experiments on the effectiveness of ethylene dichloride emulsion for the control of *Aegeria* (*Conopia*) *exitiosa*, Say, were carried out during 1936 in central Georgia [*cf. R.A.E.*, A **25** 237] and in 1937 in southern Illinois and western New York also. Applications were made by spraying the soil immediately surrounding the tree, allowing the lower part of the trunk to receive some of the spray, or by pouring the liquid round the base of the tree. There was practically no difference in the effectiveness of the two methods. The ethylene dichloride

injured two trees only; in both cases the liquid had been applied by pouring and may have run down holes close to the tree. Paradichlorobenzene crystals, used as a control, caused injury to a number of younger trees. Throughout the experiments, the higher dosages of ethylene dichloride emulsion gave good control; the material maintained its effectiveness when the soil temperatures were too low for the effective use of paradichlorobenzene, and was slightly less expensive. For trees 1, 2, 3 and 4–5 years old, small older trees and older trees of average or large size, the recommended dosages are $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, and $\frac{1}{2}$ U.S. pint of $7\frac{1}{2}$, 15, 15, 20, 20 and 25 per cent. emulsion, respectively. After the liquid has been applied, a little soil should be placed against the trunk of the tree to prevent surface loss of vapour.

Spencer (H.) & Osburn (M. R.). **Citrus Insect Projects of the Orlando Laboratory.**—*J. econ. Ent.* **31** no. 6 pp. 728–730, 1 ref. Menasha, Wis., 1938.

The principal insects and mites that attack *Citrus* in Florida in the order of their present importance are *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm., Coccids, principally *Lepidosaphes beckii*, Newm., and *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), Aleurodids, chiefly *Dialeurodes citri*, Ril. & How., and *D. citrifolii*, Morg., *Paratetranychus citri*, McG., and *Tetranychus sexmaculatus*, Riley. Aphids, especially *Aphis spiraecola*, Patch, and *A. gossypii*, Glov., appear at times and are particularly injurious to young trees; and *Pseudococcus citri*, Risso, sometimes becomes injurious on orange and, particularly, grapefruit trees. Accounts are given of investigations made during recent years into the control of the most important, many of the results of which have already been noticed [*R.A.E.*, A **24** 386; **25** 88; **26** 727]. Used alone, wettable sulphur at 5–10 lb. per 100 U.S. gals. gave excellent kill of *Phyllocoptruta oleivorus* but weathered so fast that it afforded less protection against reinfestation than lime-sulphur. Various adhesives were therefore tested, and hydrated lime with aluminium sulphate (3 lb. of each per 100 U.S. gals.) was found to prolong the period of effectiveness until control was as good as that given by lime-sulphur with wettable sulphur [**24** 386]. However, serious outbreaks of Coccids followed the use of 6 lb. of each. A method of estimating infestations of Coccids or Aleurodids rapidly and without the use of a microscope was worked out. Equal numbers of leaves are clipped from each tree of the plot, and 500 leaves are examined and classed as uninfested, lightly infested (with 1–20 scales or whiteflies) moderately infested (with 21–50) and heavily infested (with more than 50). At harvest, the fruits are handled in the same way. No distinction is made between living and dead individuals. If information on mortality is wanted, supplementary examinations are made with the aid of a microscope. It has been ascertained that there are two peaks of reproductive activity of *C. ficus* annually, in March–April and July–August. It appears that spraying with oil emulsion during the first of these periods gives better control than spraying later in the year. Investigations that have been in progress for more than two years indicate that should fruit-flies enter the main *Citrus*-growing areas of the south-east, a bait spray of tartar emetic [antimony potassium tartrate], molasses and water, as used for the control of *Anastrepha acidusa*, Wlk., and *A. suspensa*, Lw. [**24** 541],

would not injure *Citrus* if the " droplet " method, in which only 5 or 6 U.S. pints are applied to each tree, was employed. Satisfactory control of *Paratetranychus citri* has been obtained by spraying in June with oil emulsion.

Osburn (M. R.) & Spencer (H.). **Effect of Spray Residues on Scale Insect Populations.**—*J. econ. Ent.* **31** no. 6 pp. 731–732. Menasha, Wis., 1938.

General observations in Florida indicated that accumulations of road dust and residues from insecticide and fungicide sprays and dusts on *Citrus* foliage and fruit might increase infestation by Coccids, probably enabling the crawlers to become established by protecting them from direct sunlight and affording them a foothold. During the winter of 1936–37, an examination was made of the populations of *Lepidosaphes beckii*, Newm., and *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) on trees that had been used during the previous season for experiments on the control of *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm. In February 1937, there were 1·17 times as many scales on leaves from a plot sprayed with 2 gals. lime-sulphur per 100 gals. as on the control. The proportion increased slightly with the visible residue, and was 1·79 on leaves sprayed with 10 lb. wettable sulphur, 3 lb. hydrated lime and 3 lb. aluminium sulphate per 100 U.S. gals. water. Leaves from a plot treated with 2 U.S. gals. lime-sulphur, 6 lb. lime and 6 lb. aluminium sulphate per 100 U.S. gals. water had 3 times as many, and those sprayed with 10 lb. wettable sulphur, 6 lb. lime and 6 lb. aluminium sulphate per 100 U.S. gals. nearly 7 times as many as the control [*cf.* preceding abstract]. In October, 55·3 and 51·5 per cent., respectively, of the fruits on these two plots bore 51 or more scales each. Fruits from the other plots were less infested. These fruits had not received any residue-leaving sprays during their development, but were attacked by the progeny of scales developed on leaves and branches during the previous season. Mixtures of wettable sulphur and adhesives built up higher populations than corresponding mixtures in which the wettable sulphur was replaced by lime-sulphur. The wettable sulphur used contained blood albumen. If any mortality of crawlers resulted from the use of sulphur, it must have been slight.

Bieberdorf (G. A.) & Fenton (F. A.). **Control of the Poinsettia Root Aphid.**—*J. econ. Ent.* **31** no. 6 pp. 733–734. Menasha, Wis., 1938.

A root Aphid of the genus *Pemphigus* was first reported in December 1937 as infesting practically mature poinsettia plants in a greenhouse in south-central Oklahoma. Not all the plants were infested, most of the Aphids being on the larger ones and those that were potted during September and early October. None of the infested plants showed signs of injury. The Aphid is subterranean and sluggish and apparently feeds on the roots only, especially the most easily accessible. Infestation was never found where the soil was tightly packed round the roots.

Control experiments were made with 7 different soil treatments, of which three showed promise. The others either failed to give more than 50 per cent. kill or injured the plants. Dusting the earth ball and the inside of the pot with a dust of nicotine (5 per cent.) and

hydrated lime gave good control with little root injury, and loosening the ball and submerging it in a solution, previously heated to 110°F., of nicotine sulphate, soap and water, with or without the addition of lemon oil, also gave good control and caused no injury.

CREIGHTON (J. T.). **Factors influencing Insect Abundance.**—*J. econ. Ent.* **31** no. 6 pp. 735–739. Menasha, Wis., 1938.

Feeding experiments in Florida on *Dysdercus suturellus*, H.-S., and *Alabama argillacea*, Hb., indicated that deficiency of diet affects the general vitality of insects and the fecundity of the females. Experiments on *A. argillacea* showed that difference or variations in the elements present in the soil in which the food-plant was grown also affected mortality of larvae and fecundity of females. Particular attention was given to the elements of which only traces are present. It is thought that absorption of elements by plants, directly through the leaf surface or by way of the root system, though limited in its effectiveness for immediate control, may have its use in reducing populations over an extended period. There are indications that increases in insect populations following the application of fungicides may be due more to a physiological change in the cell sap than to a destruction of beneficial fungi.

ELLISOR (L. O.), GAYDEN (J. H.) & FLOYD (E. H.). **Experiments on the Control of the Velvetbean Caterpillar,** *Anticarsia gemmatilis* **(Hbn.).**—*J. econ. Ent.* **31** no. 6 pp. 739–742, 2 refs. Menasha, Wis., 1938.

Four field experiments, based on the results of preliminary experiments in 1936, were carried out in Louisiana in the autumn of 1937 on the control of *Anticarsia gemmatalis*, Hb., on soy beans [*R.A.E.*, A **18** 678, 679] with dusts of cryolite, mixtures of cryolite and talc, and two brands of safened calcium arsenate. Cryolite, when applied at the rate of 9–10 lb. per acre, gave excellent control of the larvae. A mixture composed of equal parts of cryolite and talc applied at the rate of 12, 14 and 16 lb. per acre on three test plots gave good field control, but the toxic action appeared to be slightly slower than when cryolite was used alone. A mixture of 1 part cryolite and 2 parts talc applied at the rate of 15 and 13 lb. per acre, and one of 1 part cryolite and 3 parts talc applied at 15 lb. per acre in two tests, gave fair field control, but the action of the weaker mixture was very slow. Two brands of safened calcium arsenate, each applied to three test plots at rates varying from 6 to 13 lb. per acre, gave good control, but caused injury to the plants, the amount of which appeared to be correlated with the rate of application, the age of the beans and the weather conditions prevailing after dusting.

CREIGHTON (J. T.), HUNTER (W. P.) & BROWNLEE (J. M.). **Progress Report on the Investigations of Aliphatic Thiocyanates as Contact Insecticides.**—*J. econ. Ent.* **31** no. 6 pp. 745–750, 6 refs. Menasha, Wis., 1938.

Since the spring of 1936, tests have been made in Florida on the toxicity of B butoxy B′ thiocyanodiethylether to a number of pests of ornamental plants and *Citrus* in nurseries or in the field. A commercial concentrate containing 23 per cent. of the thiocyanate together

with an oil-soluble anhydrous emulsifier and pine oil, and a special concentrate consisting of a combination of the thiocyanate with an oil-soluble anhydrous emulsifier and satisfactory petroleum oils were used. A spreader was used with the commercial concentrate; it was a 10 per cent. solution of a complex mixture of sulphonated aromatic phenolic amines. In tests against *Dialeurodes citri*, Ril & How., on *Citrus*, the special concentrate gave 80, 87·5, 94·5 and 95·1 per cent. kill at $\frac{2}{3}$, 1, $1\frac{1}{2}$ and 2 per cent. concentration, respectively. The $1\frac{1}{2}$ per cent. concentration contained 0·0713 per cent. thiocyanate and 0·0937 per cent. oil and was applied at 95°F. The commercial concentrate caused larval mortality ranging from 37·9 per cent. when it was applied at 1 : 2400 plus spreader at 1 : 600 up to 88·5 per cent. when applied at 1 : 1600 plus spreader at 1 : 200, and adult mortality ranging from 95 per cent. with dilutions of 1 : 2400 plus spreader at 1 : 200 up to 100 per cent. with dilutions of 1 : 1000 to 1 : 1600. The most effective spray was one that contained the thiocyanate at 1 : 1600 and the spreader at 1 : 400. It is important that the application should be made when the adults are most abundant. Only the commercial concentrate, at dilutions varying from 1 : 720 plus spreader at 1 : 180 up to 1 : 3200 with spreader at 1 : 800 was used in the 54 tests against *Aphis spiraecola*, Patch, on *Citrus*. These dilutions produced mortalities of 98·3 and 46 per cent., the sprays being applied at 82° and 91°F., respectively. The thiocyanate was an effective and economical aphicide at dilutions of 1 : 1200 to 1 : 2400. In tests on old infestations of *Pseudococcus citri*, Risso, on *Citrus*, in which the mealybugs had become layered, an application of the commercial concentrate at a dilution of 1 : 800 plus spreader at 1 : 200 gave a total kill of 57 per cent., and 98·5 per cent. kill of the upper layer. Aliphatic thiocyanates are valuable in the control of crawlers and first-stage nymphs of armoured scales such as *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), but alone do not seem to be effective against the adults. However, it appears that they might be combined with oils, making possible a reduction in the quantity of oil. Aliphatic thiocyanate at 1 : 2000 plus spreader was toxic to *Phyllocoptruta* (*Eriophyes*) *oleivorus*, Ashm., and is compatible with lime-sulphur. No applications caused any immediate or cumulative injury to the *Citrus* foliage or fruit.

Results are also given of tests carried out on *D. citri*, *C. ficus*, *P. citri* and several species of Aphids infesting a number of ornamental plants, together with a table showing the toxicity of the thiocyanate at various concentrations to seven of these plants. The results of the tests indicated the strengths at which it may safely be applied to the varieties represented. If it is necessary to increase the concentration, the material should be syringed off $\frac{1}{2}$–$1\frac{1}{2}$ hours after application.

English (L. L.) & Graham (C. P.). **Soil Sterilization Experiments on killing Larvae of the White-fringed Beetle,** *Naupactus leucoloma* **Boh.**—*J. econ. Ent.* **31** no. 6 pp. 769–773, 3 refs. Menasha, Wis., 1938.

Naupactus leucoloma, Boh., was first found in Alabama in 1936 [*R.A.E.*, A **25** 700], and the area was quarantined in 1937. This necessitated the treatment of the soil balls on nursery stock before it could be moved from the area. In experiments on the sterilisation of the soil, carbon bisulphide emulsion, numerous common contact

insecticides and sodium arsenite all failed to control the larvae at concentrations safe to nursery plants. Potassium cyanide in aqueous solution was the only chemical that showed definite toxicity to the larvae in the soil ; it was much less toxic to larvae that were removed from the soil before being placed in the solution. The potassium cyanide was very toxic to plants, but is promising for the sterilisation of soil that does not contain plants. Various fumigants, petroleum fractions, hot water and steam treatment and electrical heating devices all gave negative results.

Davis (A. C.). **Further Notes on Cyanide Fumigation of Mushroom Houses.**—*J. econ. Ent.* **31** no. 6 pp. 777–778, 1 fig., 1 ref. Menasha, Wis., 1938.

During October 1937, tests were made in several mushroom houses at peak heat to determine the concentration of hydrocyanic acid gas obtainable with a portable generator, in which the gas is generated outside the building to be fumigated and forced in by the pressure developed in its generation. The advantages of this method are that the operator remains in the open air and the cheapest materials (sodium cyanide and sulphuric acid) are used. The results are compared with those previously obtained in the same houses and under approximately the same conditions with granular calcium cyanide and sodium cyanide (1–1½–2) in pots. Granular calcium cyanide, sodium cyanide in the generator and sodium cyanide in pots, respectively, gave maximum concentrations of the gas in mg. per litre of 1·26, 1·90 and 2·60 at the top of the house and 1·14, 1·59 and 2·37 at the bottom, and mean concentrations, calculated on exposure for 100 minutes or until concentration dropped to 0·4, of 0·77, 1·17 and 1·18 at the top and 0·74, 1·10 and 1·03 at the bottom. With the first method, 75 minutes were required for the concentration to drop to 0·4 at the top and bottom of the house, and with the third method, 88 and 82 minutes, respectively. With the portable generator, the concentration was still above 0·4 at the end of 100 minutes.

Farrar (M. D.) & Reed (R. H.). **Spontaneous Heating of Insect Baits.** —*J. econ. Ent.* **31** no. 6 p. 779, 2 figs. Menasha, Wis., 1938.

In experiments to determine the spontaneous heating of prepared grasshopper baits packed in a large wooden box, practically none occurred in a bait of 50 lb. bran, 50 lb. ground maize cobs, 3 lb. sodium arsenite and 2 U.S. gals. oil, but it was considerable when 5 per cent. water by weight was added, the maximum temperature reached being 119°F. Heating also occurred in the two other baits tested, both of which contained water at the rate of 8 U.S. gals. per 100 lb. carrier. Heating was followed by a gradual loss in temperature with the bait undergoing an ensilar process that produced very little heat. Moulding occurred where air came into contact with the bait.

Ainslie (C. N.). **Flight of** *Alabama argillacea* **(Hbn.).**—*J. econ. Ent.* **31** no. 6 p. 779. Menasha, Wis., 1938.

On the night of 15th September 1938, when the temperature was about 55°F., a great flight of *Alabama argillacea*, Hb., which had not been previously observed during the season, was noted at Sioux City, Iowa.

Dahms (R. G.) & Kagan (M.). **Egg Predator of the Chinch Bug.**—*J. econ. Ent.* **31** no. 6 pp. 779–780. Menasha, Wis., 1938.

During experiments on *Blissus leucopterus*, Say, in Oklahoma during 1938, it was noticed that the Melyrid, *Collops quadrimaculatus*, F., usually occurred at the rate of about one to each *Sorghum* plant where the chinch bugs were abundant and appeared to feed on their eggs. Of several beetles taken into the laboratory and fed exclusively on eggs of *B. leucopterus*, 6 ate 1,404 eggs in 10 days. The beetles could not be induced to feed on nymphs or adult bugs.

Essig (E. O.). **Some new and little known Aphididae of California.**—*J. econ. Ent.* **31** no. 6 pp. 780–781. Menasha, Wis., 1938.

A list is given of 25 species of Aphids either new to California or not well known to entomologists. The food-plant of each and the part of the state in which it was collected are shown.

Boyce (A. M.). **Dinitro-o-Cyclohexylphenol in the Control of the Citrus Red Mite.**—*J. econ. Ent.* **31** no. 6 pp. 781–782, 1 ref. Menasha, Wis., 1938.

Studies on dinitro-o-cyclohexylphenol in dusts for the control of *Paratetranychus citri*, McG. [*cf. R.A.E.*, A **24** 433] showed that when it is incorporated with such alkaline diluents as diatomaceous earth, talc or lime, it reacts with certain of the components of the diluent, with the resultant formation of salts that are less effective than the original compound. It was found that ligno-cellulosic materials do not so react, walnut-shell flour and redwood bark flour appearing to be the most promising as regards general properties and commercial availability. Satisfactory mixtures may be prepared by mechanical mixing, but more homogeneous mixtures are obtained by dissolving the compound in a volatile solvent and atomising the solution on to the diluent. A mixture of toluene and carbon tetrachloride is a satisfactory solvent. Dusts containing about 1 per cent. of the toxic agent were the most practical for field use, and gave good results in California in 1937 against *P. citri* and *Tetranychus sexmaculatus*, Riley, on *Citrus*, and *T. telarius*, L., and *Bryobia praetiosa*, Koch, on walnut and peach.

Strong (L. A.). **What is Entomology ?**—*Smithson. Rep. 1937* (Publ. 3467) pp. 377–383, 16 pls. Washington, D.C., 1938.

The general scope of economic entomology is outlined, and attention is drawn to the practical value of taxonomic and biological studies of insects. The organisation of entomological work in the United States is very briefly described. The appropriation of the Bureau of Entomology and Plant Quarantine in 1937 was over £1,000,000 or more than 64 times as great as in 1904 when the Bureau was formed, and the additional provision of some £2,500,000 in emergency funds resulted in a peak employment figure of 27,000 people on pest-control projects. In conclusion the author suggests a supplementary definition of entomology as " a science that contributes materially and without ostentation to the health, comfort, welfare, and happiness of the human race and of a large part of the animal kingdom."

HARDY (J. E.). *Plutella maculipennis*, **Curt., its Natural and Biological Control in England.**—*Bull. ent. Res.* **29** pt. 4 pp. 343–372, 1 pl., 10 figs., 16 refs. London, 1938.

Owing to the absence of natural enemies in New Zealand, *Plutella maculipennis*, Curt., a pest of crucifers that was introduced there about 60 years ago, has reached a permanently high level of population [*cf. R.A.E.*, A **19** 141]. An account is given of work at the Laboratory of the Imperial Institute of Entomology at Farnham Royal in 1936 on the collection and breeding of parasites of the moth for export to New Zealand, together with information on the bionomics of the pest accumulated in the course of the investigations. All stages and the distribution of the moth are described.

Laboratory experiments on the effect of temperature and humidity showed that atmospheric humidity had no effect on the immature stages, as they developed in a microclimate characterised by high humidity, but that rain might wash young larvae off the leaves. Breeding and development occurred between 10 and 40°C. [50 and 104°F.], and adults were active up to 50°C. [122°F.]. This tolerance probably accounts for the wide distribution of the moth. Young pupae and adults survived for several months, and eggs and larvae 2 and 6 weeks, respectively, at 0°C. [32°F.]. The moth usually hibernates as an adult, although a few pupae may survive the winter.

From several thousand cocoons of *P. maculipennis*, collected in England, 14 species of parasites, including 8 hyperparasites, were recovered, and a key to the adults of these is given. The only two that were numerous were *Angitia cerophaga*, Grav., and *A. fenestralis*, Hlmgr., which infested the larvae and exercised almost complete control. They have been recorded as parasites of *Plutella* throughout the world, are not appreciably affected by hyperparasitism, and have alternative hosts, a list of which is given, in which they pass the winter. *Apanteles sicarius*, Marsh., appeared to be only an occasional parasite of the larva, but it is the only one that may not need an alternative host in winter in countries cold enough to induce hibernation of the adult hosts. No parasites of the eggs are known, and there is very little control by pupal parasites or by fungi or bacteria in England. Syrphids possibly attack the larvae.

Shipments to New Zealand comprised over 25,000 parasitised cocoons of *Plutella*, collected in the field, from which 10,000 adults of *Angitia* were obtained, and over 50,000 laboratory-bred pupae of *Angitia*, the adults from more than half of which arrived in good condition.

WILSON (F.). **Notes on the Insect Enemies of Chermes with particular Reference to *Pineus pini*, Koch, and *P. strobi*, Hartig.**—*Bull. ent. Res.* **29** pt. 4 pp. 373–389, 12 refs. London, 1938.

Investigations on the natural enemies of *Chermes* (*Pineus*) *pini*, L., and *C.* (*P.*) *strobi*, Htg., on pines were carried out in England from 1932 to 1934, with a view to introducing them into Australia, where *C. pini* has become a serious pest of *Pinus radiata* and *P. pinaster*.

No parasites were found, but many predators were observed. Of these the most important, in descending order of effectiveness, were *Leucopis obscura*, Hal., *Lestodiplosis pini*, Barnes, *Hemerobius stigma*, Steph., *Wesmaëlius concinnus*, Steph., and *Exochomus quadripustulatus*, L. Brief descriptions are given of the morphology and bionomics

of these predators, and of the ways in which they attack *Chermes*. It is considered that all these species are suitable for introduction into Australia [*cf. R.A.E.*, A **25** 321 ; **26** 449].

Puparia of *L. obscura* collected from late summer to late winter were all parasitised by *Lygocerus testaceimanus*, Kieff., *Amblynotus longitarsis*, Reinh., or *Aphidencyrtus aphidivorus*, Mayr. *Lestodiplosis pini* also attacks *Leucopis obscura*, and further investigations should be carried out on the extent to which this renders it undesirable.

H. stigma is an effective predator on account of its large numbers and constant activity, its efficiency in finding *Chermes* in concealed positions and the fact that it has several generations a year. *W. concinnus* is less useful because it is active only from April until August. The wide host range of *E. quadripustulatus* would tend to make it disperse, but its large numbers, maintained by alternative hosts, enable it to deal rapidly and effectively with any sudden increase in infestation by *Chermes*.

Notes are also given on a number of minor predators. Although of little importance in England, these might prove of value in the control of *C. pini* in Australia, but they should not be introduced until their relationships with other predators are understood.

Brightwell (S. T. P.). **A Method for investigating Membrane Permeability.**—*Bull. ent. Res.* **29** pt. 4 pp. 391–403, 6 figs., 38 refs. London, 1938.

None of the methods for testing the permeability of the more complicated biological membranes has proved suitable for an accurate study of small insect membranes with reference to the physiological action of insecticides, particularly those applied externally. Apparatus is described that is designed to deal with these weak but relatively impermeable membranes without introducing any complicating factors due to method.

Baranov (N.). **Neue Indo-Australische Tachinidae.** [Some new Indo-Australian Tachinids.]—*Bull. ent. Res.* **29** pt. 4 pp. 405–414, 8 figs. London, 1938.

The new species described include *Dolichocolon australe* and *Eulachina mungomeryi*, bred from *Laphygma* (*Spodoptera*) *exempta*, Wlk., in Queensland, and *Cadurcia vanderwulpi* and *Dolichocolon orbitale*, from *Hapalia machaeralis*, Wlk., in India.

Nixon (G. E. J.). **Notes on the Taxonomy and Synonymy of *Zele*, Curtis, and *Macrocentrus*, Curtis (Hym., Braconidae).**—*Bull. ent. Res.* **29** pt. 4 pp. 415–424, 2 figs. London, December 1938.

Keys, followed by taxonomic notes, are given to the adults of 9 species of *Zele*, including 4 new species. Taxonomic notes are also given on the adults of 5 other species of *Zele* not included in the keys, 3 of which are referred to *Macrocentrus*, as is *Leptozele trimaculatus*, Cam., the type of its genus, the adults of which are redescribed in detail. Both *Zele* and *Macrocentrus* appear to be of some economic importance as parasites of Lepidoptera.

DUARTE (A. J.). **Problems of Growth of the African Migratory Locust.** —*Bull. ent. Res.* **29** pt. 4 pp. 425–456, 12 figs., 16 refs. London, 1938.

Abundant comparative biometrical data are given for various parts of the body, and for their ratios, in isolated and crowded hoppers of *Locusta migratoria migratorioides*, R. & F. The results are analysed from the point of view of the relative growth of the parts, and the divergence between the two phases in respect of the critical ratios is noted. These data are supplemented by observations on body weight in various instars of both phases, and the rate of its increase.

Crowded hoppers, in which the hind tibiae were amputated to prevent jumping, developed a less pronounced gregarious type of coloration than the controls.

THORPE (W. H.). **Further Experiments on Olfactory Conditioning in a parasitic Insect. The Nature of the Conditioning Process.**—*Proc. roy. Soc.* (B) **126** no. 844 pp. 370–397, 3 figs., 13 refs. London, 1938.

The following is taken from the author's summary: In a previous paper [*R.A.E.*, A **26** 1], it was shown that the Ichneumonid, *Nemeritis canescens*, Grav., can be induced to develop a positive response to the odour of an abnormal host, *Achroia* (*Meliphora*) *grisella*, F., by rearing it artificially on that host, and that this effect is due, in part, to the influence operating during the larval life [**26** 1] and, in part, to the contact of the newly emerged adult parasite with the host larvae [**26** 2]. In the latter case, if the parasites are closely confined with the host larvae, a good deal of tentative stabbing with the ovipositor takes place and a few eggs may be laid. There is, therefore, an opportunity for an association to be established between the act of oviposition and the odour of the larvae. In the former case, of course, no such association can be established, so that a conditioned response produced by influences during the larval life cannot be a simple reflex association with the act of oviposition, but is rather something in the nature of a " becoming aware " of a new factor as part of a favourable environment. The primary object of the experiments described in the present paper was to elucidate the nature of the conditioning process.

Adult *Nemeritis* reared from the normal host (*Ephestia kuehniella*, Zell.) were confined immediately on emergence in an apparatus through which was pumped a stream of air that had passed over living *Achroia* larvae. In this way, direct association between the odour of the host and the act of oviposition was ruled out. Nevertheless, when tested in the olfactometer these insects showed just as effective a conditioning as those actually confined in contact with the host. The reaction of *Nemeritis* to the odour of various chemical substances was examined, and cedar-wood oil was found to be convenient for the experiment. Its odour is repellent to the normal adults, but if they were exposed to it in an air stream, a high degree of tolerance was produced without in any way injuring them. Within certain limits, variation in the period of conditioning did not alter the intensity of the final effect. Thus, 24–36 hours in the conditioner was as effective as 6 days. The effect of conditioning both to *Achroia* and to cedar-wood oil was greatest immediately after exposure. On subsequent isolation, it decreased rather irregularly and approached zero after about 10 days.

There was no definite evidence that younger insects are more readily conditioned than older ones. Contact with *Ephestia* after conditioning to *Achroia* reduced the attractiveness of the latter insect.

A modification of the olfactometer was made to test the response of *Nemeritis* to the odour of its own species, and it was shown that this odour exerts a slight attraction. Previous observation showed that the parasite lays eggs more readily in larvae covered with webbing and faeces than in clean larvae. Experiments in the olfactometer, in which clean *Ephestia* larvae were offered as bait in one arm and webbing and faeces without any larvae in the other, showed that this does not apply to perception at a distance. So far as odour alone is concerned, the larvae themselves are far more attractive to the parasite than is webbing and faeces.

The experiments have given no support for the theory of the inheritance of acquired characters. It is concluded that conditioning in *Nemeritis* is not a simple association between the experience of a given constituent of the environment (*e.g.* odour) and the calling forth of a single specialised response (*e.g.* oviposition). It is rather the association of the given constituent with a favourable environment as a whole, not a particular element of it, giving rise in this way to a positive response that will tend to keep the parasite in the type of environment in which the host itself occurs.

Department of Scientific and Industrial Research. **Common Pests of Grain and other Stored Produce.**—Med. 8vo, vi+ 18 pp., 8 pls., 7 figs. London, H.M.S.O., 1939. Price 4*d*. Wall Chart, 25″ by 20″, 6*d*.

In 1938, Prof. J. W. Munro made a survey of the extent of insect infestation of stored grain and grain products in Great Britain, which disclosed an unexpected lack of knowledge of the simple principles of warehouse hygiene. In the present booklet, the common grain pests are briefly described, and practical remedial measures are given for general use in barns and warehouses, followed by details of those measures requiring technical knowledge. A chart suitable for hanging in warehouses or barns and summarising the information in the booklet has also been prepared and is sold separately.

Butler (C. G.). **A Further Contribution to the Ecology of** *Aleurodes brassicae* **Walk. (Hemiptera).**—*Proc. R. ent. Soc. Lond.* (A) **13** pt. 10–12 pp. 161–172, 1 graph, 4 refs. London, 1938.

The following is based on the author's summary of further investigations at Cambridge on the relationship between the cabbage whitefly, *Aleurodes brassicae*, Wlk., and the physical factors of its environment [*cf. R.A.E.*, A **27** 61] : Various parasites and predators of *A. brassicae* are discussed ; the most important are two Eulophid parasites of the later larval stages, *Encarsia partenopea*, Masi, and *E. tricolor*, Förster [*cf.* **24** 626]. It is probable that both are of Italian origin and are imported annually in parasitised pupae of *A. brassicae* on vegetables from Italy ; although they increase rapidly under favourable conditions, they effect little control in England, since they are apparently unable to withstand the winter. Accounts are given of experiments on the Aleurodid to show the effects of high and low temperatures on various stages, and the effect of humidity.

The optimum temperature for adults is below 30°C. [86°F.], but 22 per cent. of those used in one experiment withstood a temperature of 37°C. [98·6°F.] for 5 days. Low temperatures cause heavy mortality among eggs in both autumn and spring. About 90 per cent. of the pupae and adults withstood —15°C. [+5°F.] in autumn, but in spring only about 50 per cent. did so. Unmated males can withstand much greater cold than those that have paired. There is a direct relationship between temperature and the number of eggs laid in a given time at a constant saturation deficiency, within the limits of experimental error. At a constant temperature of 18°C. [64·4°F.] and varying saturation deficiencies, only very small fluctuations in the number of eggs laid were noted. This is probably due to the fact that the insect, living on the lower surface of the leaf, is surrounded by a micro-environment in which the temperature is similar to that of the external environment but the humidity is much greater owing to transpiration.

The causes of migration are discussed ; it may be brought about by any factor causing the food-plant to wilt or by over-crowding of the adults, but the most important factor is temperature. Low temperatures in autumn cause migration to places of shelter on the food-plants, and the rise in mean daily temperature in spring causes migration to fresh food-plants. For successful migration, the atmospheric temperature must exceed 6°C. [42·8°F.] and the saturation deficiency be less than 6 mm. of mercury. The extent to which the biotic and physical factors of the environment affect *A. brassicae* in the field is discussed. A fairly good theoretical estimate of the numbers present in the field at a given time may be obtained from a previous study of these factors.

Les poudreuses.—[*Publ.*] *Déf. Vég. Dir. Aff. écon.* [*Maroc*] no. 11, 46 pp., 25 figs. Rabat, 1937.

The advantages and disadvantages of dusts as compared with sprays for the control of insect pests and fungi infesting plants are briefly discussed. Notes are given on the different components of a dusting apparatus, and various types of dusting equipment are described and illustrated. The method of use of certain types, the cost of dusting and the factors influencing the effectiveness of treatment are also dealt with.

Pussard (R.). **Acclimatation de** *Cryptolaemus montrouzieri* **Muls.**—*C. R. Acad. Agric. Fr.* **24** no. 29 pp. 974–976. Paris, 1938.

In October 1935, adults of *Cryptolaemus montrouzieri*, Muls., which was introduced into France in 1918 for the control of Coccids, but which was not known to have become very well established or to have spread, were found at Mentone and Monaco on the supposed sites of colonisation from the insectarium at Mentone. In August 1937, an outbreak of *Pseudococcus citri*, Risso, in an orange grove at Cap d'Antibes was checked by this Coccinellid, numerous individuals of which in all stages were found. No liberation appears to have been made at Antibes, and the winters preceding the finding of the colony were severe, particularly that of 1928–29, when the temperature fell to —11°C. [12·2°F.]. In January 1938, a few weeks after a cold period during which the temperature fell to —7°C. [19·4°F.], a few pupae and active adults could still be found. In June and July, the grove was almost free from *P. citri* and numerous individuals of *C. montrouzieri*

in different stages were taken. Extensive rearing of the Coccinellid in the insectarium has been arranged, and a few colonies were liberated in 1938. In July and August, its presence was noted in two other localities. It is thought that in the 20 years that have elapsed since the original colonisation, a strain resistant to local climatic conditions has probably been built up.

Saalas (U.). **Ueber den Maikäfer** (*Melolontha*) **in Finnland.** [The May-beetle in Finland.]—*Z. PflKrankh.* **49** pt. 1 pp. 42–50, 1 map, 12 refs. Stuttgart, 1939.

Melolontha hippocastani, F., is the only species of its genus that occurs in Finland, where it has sometimes caused considerable losses, but has never been closely investigated. From information collected by the author, particulars are given on its distribution in Finland, where it extends up to 65° N. lat. Serious injury has occurred up to 63°, where the annual temperature averages 2°C. [35·6°F.], chiefly in more or less dry sandy soils, and particularly in areas that have been burned. *M. hippocastani* has been destructive in recent years, but it is not known whether the outbreak is now increasing or decreasing. It appears to have a 5-year cycle. Adults appear to prefer birch, though other trees, including apple, are also favoured. No control measures have ever been undertaken on a large scale, but destruction of the larvae by soil cultivation has given good results.

Heinze (K.) & Profft (J.). **Zur Lebensgeschichte und Verbreitung der Blattlaus** *Myzus persicae* **(Sulz.) in Deutschland und ihre Bedeutung für die Verbreitung von Kartoffelviren.** [A Contribution to the Life-history and Distribution of *M. persicae* in Germany and its Importance in the Spread of Potato Viruses.]—*Landw. Jb.* **86** pp. 483–500, 9 figs., 1938. (Abstr. in *Z. PflKrankh.* **49** pt. 1 p. 60. Stuttgart, 1939.)

Recent investigations in Germany indicate that potato viruses there are not transmitted by Capsids, Jassids, *Aphis rumicis*, L., or *Macrosiphum solanifolii*, Ashm. (*gei*, auct.). *M. solani*, Kalt. (*Myzus pseudosolani*, Theo.) is an occasional vector, and *Myzus persicae*, Sulz., is the chief one [*R.A.E.*, A **27** 157]. An account is given of the life-history of *M. persicae*. In 1937, migration occurred from 19th May to early June, and the infestation of potato reached a maximum in summer. The return migration of the gynoparae took place from the end of September to early October, and oviposition occurred from mid-October to early December. Neither in Pomerania nor in Berlin were the Aphids found in the winter on cabbage in the field, but in the laboratory they survived at −4°C. [24·8°F.] for 2 days, though they died at −9°C. [15·8°F.]. *M. persicae* occurs throughout Germany, except, possibly, in high mountain areas. The eradication of peach trees in districts where seed potatoes are grown is one of the measures advocated [*loc. cit.*].

Nolte (H. W.). **Zur Biologie des Lilienhähnchens.** [A Contribution to the Biology of *Lilioceris lilii*.]—*Kranke Pflanze* **16** pt. 1 pp. 7–10, 8 refs. Dresden, 1939.

Of recent years, infestation by *Lilioceris lilii*, Scop., has increased in Central Germany in gardens in which white lilies (*Lilium candidum*)

are growing, and both the adults and the larvae have caused considerable injury to the plants, sometimes preventing them from flowering. Investigations on this Criocerid in France and Germany [*R.A.E.*, A **20** 256; **23** 103, etc.] are briefly summarised. In the author's observations, the adults appeared in the second half of April. Pairing soon occurred, followed by oviposition, which continued until early July. There were 3–12 eggs in each batch. The egg, larval and pupal stages lasted 8–10, 17–24 and about 21 days, respectively, the larvae migrating from the leaves to the ground to pupate. Some of the adults emerging at the end of June produced a second generation, the adults of which fed for a time and then, together with the others of the first generation, entered hibernation in the ground or under leaves [but *cf.* **24** 656].

BECKER (G.). **Der gegenwärtige Stand der Hausbockkäfer-Frage.** [The present Position of the Question of *Hylotrupes bajulus*.]—*Ent. Bl.* **34** pt. 6 pp. 327–335, 26 refs. Krefeld, 1938.

This review of data on the infestation of buildings in Germany by *Hylotrupes bajulus*, L., contains statistical information and notes on the biology of the beetle and on methods of control [*cf. R.A.E.*, A **27** 202–204, etc.].

DOEKSEN (J.). **De tarwegalmuggen** *Contarinia tritici* **Kirby en** *Sitodiplosis mosellana* **Géhin (Diptera ; Cecidomyidae) in Nederland.** [The Wheat Gall-midges, *C. tritici* and *S. mosellana*, in Holland.] —*Versl. techn. Tarwe Comm.* **12** pp. 237–296, 28 figs., 2 pls., 2 pp. refs. Groningen, 1938. (With a Summary in English.)

In 1936 and 1937, considerable damage was caused to wheat in Holland by the gall-midges, *Contarinia tritici*, Kby., and *Sitodiplosis mosellana*, Géh. The causes of the outbreak are briefly discussed, and it is suggested that the increased cultivation of early varieties of wheat has prolonged the period during which oviposition is possible. Weather conditions in the summer of 1938 were very unfavourable to the spread of these Cecidomyiids, but it was not possible to say whether the outbreak was over. An account is given of their systematic position and morphology as well as of their life-history and control, largely from the literature [*cf. R.A.E.*, A **20** 484; **23** 123; **24** 347; **26** 230, etc.].

In 1938, the flight of *C. tritici* from larvae that pupated in May reached its maximum about 11th June in Zeeland. A few of the resultant larvae gave rise to adults in autumn and these oviposited on couch grass [*Agropyrum repens*], but most of the larvae hibernated in the ground. The flight of *S. mosellana* reached its maximum about 26th June in Zeeland and western North Brabant and about 22nd June in Groningen and Friesland. Some adults appeared in autumn, but the majority of the larvae hibernated.

A polyhedral disease was observed in the larvae of both species. The parasites that were taken in field emergence cages were *Isostasius punctiger*, Nees, which was the most numerous, *Macroglenes penetrans*, Kby., with its Scelionid hyperparasite, *Piestopleura thomsoni*, Kieff.,

Leptacis tipulae, Kby., and *Platygaster tuberosula*, Kieff., and an unidentified species of the same genus [*cf.* **26** 231]. Laboratory investigations showed that although the total weight of the grains was somewhat less in infested ears than in uninfested ones, the weight of 1,000 undamaged grains taken from infested ears was slightly greater than that of an equal number from uninfested ears. The mechanical injury causes a shrivelling of the kernels and serious infection by fungi and bacteria. The amount of injury in Holland does not warrant expensive measures of control. Some reduction in infestation may be expected by growing root crops following heavily infested wheat, or by cultivation of the soil surface in May to keep it loose, which reduces the moisture available for the larvae. The use of varieties of wheat that form their ears at the same time is recommended to reduce opportunities for oviposition.

Wheat was also infested by *Limothrips cerealium*, Hal., and *Haplothrips aculeatus*, F. The injury caused by these thrips is very similar to that caused by *S. mosellana*.

VAN POETEREN (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1937.** [Report on the Work of the Phytopathological Service in 1937.]—*Versl. PlZiekt. Dienst Wageningen* no. 89, 92 pp., 1 map, 5 pls. Wageningen, 1938.

Many of the pests recorded in Holland in 1937 have been noticed from previous reports [*R.A.E.*, A **26** 299, etc.]. Records are given of the occurrence of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] in both 1937 and 1938 [*cf.* **27** 62]. In one locality, damage to potato foliage by the larvae of a sawfly, *Pachyprotasis variegata*, Fall., was sufficiently severe to decrease the crop in 1937, but it did not recur in the following year. Larvae of an undetermined Anthomyiid mined the stems of rhubarb in various districts. The flea-beetle, *Psylliodes chrysocephala*, L., was injurious to rape. The adults apparently rest in summer and appear in the fields in autumn, when they attack young rape plants. The greatest injury, however, is caused by the larvae that hatch from the eggs laid in autumn and mine the stems and leaf-stalks. In the spring of 1936, the infestation was estimated as 30–40 per cent. As the larvae are inaccessible, experiments were carried out against the adults with a derris dust, but the results were inconclusive. A derris dust containing 1 per cent. rotenone killed over 80 per cent. of the larvae of *Malacosoma neustria*, L., infesting elms along the street canals in Amsterdam [*cf.* **27** 205], though the dusting was not carried out until the larvae were partly developed. There were complaints of injury to lawns and other grasslands caused by larvae of *Melolontha melolontha*, L., *Hoplia philanthus*, Fuessly, *Anomala dubia* var. *frischi*, F., *A.* (*Phyllopertha*) *horticola*, L., and *Amphimallus* (*Rhizotrogus*) *solstitialis*, L. The larvae of *A. horticola* pass the winter deep in the ground, rising to 8–12 ins. beneath the surface in spring, where they pupate without having fed. In 1937 the pupal period lasted from 19th–21st April to 3rd–8th May. The larvae of *A. solstitialis* migrate to the surface in spring and feed on the grass roots before pupating. The pupal period lasted from 28th–29th May to 13th–14th June, but the adults remained in the ground until 23rd June, as the weather was cold.

Roos (K.). **Beitrag zur Frage sind** *Oscinella frit* **L. (frühere** *Oscinis*) **und** *O. pusilla* **Meig. zwei verschiedene Arten.** [A Contribution to the Question whether *O. frit* and *O. pusilla* are two distinct Species.]—*Mitt. schweiz. ent. Ges.* **17** pt. 8 pp. 404–410, 3 figs., 8 refs. Bern, 1938.

The author records the results of investigations already noticed [*R.A.E.*, A **25** 609], showing that *Oscinella frit*, L., *O. pusilla*, Mg., and transitional forms between them occur in fields in Switzerland on all the cultivated cereals. Neither high nor low temperature had any effect on the coloration of the flies. In the laboratory, flies with entirely black tibiae (*frit* type) produced descendants with yellow variations, and the author concludes that *O. pusilla* should be regarded as a variety of *O. frit*.

Morris (H. M.). **Annual Report of the Entomologist for 1937.**—*Rep. Dep. Agric. Cyprus 1937* pp. 42–47. Nicosia, 1938.

No fumigation was carried out in Cyprus during 1937 against *Lepidosaphes beckii*, Newm., on *Citrus* [*cf. R.A.E.*, A **26** 107], although the Coccids were still present in the previously infested area, fumigation having failed to effect eradication. The only parasite obtained in investigations on *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., was *Aphytis chrysomphali*, Mercet, but neither this Aphelinid nor the Coccinellid, *Chilocorus bipustulatus*, L., which also occurs, was sufficiently abundant to exercise considerable control. *Icerya purchasi*, Mask., was again found in one place on *Citrus* plants imported from Palestine in 1934. *Dociostaurus maroccanus*, Thnb., was in general less abundant than in 1936, and *Calliptamus italicus*, L., was considerably less so. Injury to cotton by *Platyedra gossypiella*, Saund., and *Earias insulana*, Boisd., was less severe than during 1936. Heavy attacks by *Lasioderma serricorne*, F., occurred on tobacco undergoing fermentation and in stored cumin seed, and *Tenebroides mauritanicus*, L., was associated with it in both cases. Olive trees in several localities were severely infested by *Euphyllura olivina*, Costa, during May. Experiments on the control of *Dacus oleae*, Gmel., on olive confirmed the results obtained during the previous year [**26** 108], ammonium sulphate again being the best bait, and more attractive alone than in combination with grape juice. Bait-sprays again failed to effect any control. In April, five glass traps baited with a 1 per cent. solution of ammonium sulphate were placed in olive trees in five villages where olives are extensively grown, to obtain information on the seasonal occurrence of *Dacus*. Catches began, but were small, as soon as the traps were exposed, although the olive trees had not begun to flower. Numbers rose rapidly in June, fell in July–August, increased still more in September–October, fell rapidly in November and were very small in December. The increase in June occurred before a generation could have bred on olive. In experiments with baits in glass globe-type traps for *Ceratitis capitata*, Wied., on orange trees, grape juice was less attractive than in 1936, while Clensel appeared to be more so. The most attractive were molasses, fig extract, molasses with 1 per cent. ammonium sulphate, Clensel, and bran and borax. Plums were attacked by *Anarsia lineatella*, Zell., *Cydia* (*Laspeyresia*) *funebrana*, Treitschke, and *Polychrosis botrana*, Schiff., the last-named species being the most abundant. It had five

generations on plums and grapes in captivity; two generations of *Theresimima* (*Zygaena*) *ampelophaga*, Bayle, were also observed. *Aphelinus mali*, Hald., was present on apple in one area parasitising *Eriosoma lanigerum*, Hsm., against which it was liberated in 1936.

Wellington (J. S.). **Entomological Work.**—*Rep. Dep. Agric. S. Leone 1937* pp. 43–44. Freetown, 1938.

Fruit-piercing moths appeared earlier than usual in Sierra Leone in 1937, but *Citrus* fruits were not seriously affected until the fruits of mango and cashew [*Anacardium occidentale*] had become scarce; additional food-plant records are given for some of the species. *Aethemenes* (*Nezara*) *chloris*, Westw., a pest of rice [*R.A.E.*, A **26** 240], gave rise to five generations between 26th June and the end of November, the mean incubation period being five days, but eggs laid on 12th December by adults of the fifth generation had not hatched by 31st December. The adults become very lethargic towards the end of the year, in spite of the presence of suitable food. No stage of the Pentatomid was observed on *Rottboellia exaltata* [*cf. loc. cit*]. Coffee was again attacked by the Lycaenid borer [*Virachola* (*Deudorix*) *bimaculata*, Hew.]; hand-picking and burning of damaged berries and the removal of the wild food-plant, *Heinsia pulchella*, appeared to give effective control. Stem borers and termites were controlled by applications of a paint of lead arsenate and calcium oxide to the stems of the affected trees. There was a fairly heavy invasion of *Locusta migratoria*, L., 66 reports of swarms being received, and hoppers bred in the country.

Jacoby (M.). **Resumo dos estudos de formigueiros por meio da moldagem de cimento.** [A Summary of the Studies of Ants' Nests by Means of Cement Casts.]—*Bol. Minist. Agric. Brasil* **27** no. 1–3 pp. 21–31, 8 figs. Rio de Janeiro, 1938.

The internal structure of nests of leaf-cutting ants of the genus *Atta* [*cf. R.A.E.*, A **23** 756] is described from casts made in Brazil by pouring in liquid cement.

Report of the Agricultural Department, St. Vincent, 1937.—Fol., 43 pp. Kingstown, St. Vincent, 1938.

Some of the work on insect pests referred to in this report has already been noticed [*R.A.E.*, A **26** 83, 175]. Infestation of arrowroot by larvae of *Calpodes ethlius*, Cram. [*cf.* **20** 673] was less severe than in 1936, but caused serious losses throughout the island in October. Very little control was given by parasites [*cf.* **23** 448], owing to the dry weather. Artificial defoliation of plants to simulate the damage done by the larvae caused 18–38 per cent. reduction in the yield of rhizome, and some reduction in the average starch content of the crop. As control of this Hesperiid by dusting with Paris green has proved uneconomic, spraying with a commercial colloidal lead arsenate was tried, and one application of a suspension of 3 lb. in 100 gals. water gave effective control. The same spray was also effective later in the year against *Alabama argillacea*, Hb., which was favoured by the dry weather and defoliated about 150 acres of cotton.

Preliminary investigations on the possibilities of control of *Platyedra gossypiella*, Saund., on cotton showed that the most important causes

of reinfestation were inter-island traffic, failure to uproot all cotton plants and an inadequate close season. Resting larvae in seed buried 6–9 ins. deep did not survive the close season.

Owing to the appreciable increase in incidence of *Diatraea saccharalis*, F., and *D. canella*, Hmps., on sugar cane, planters are advised to soak all cuttings in an aqueous suspension of lime before planting, to cut the canes as low as possible at harvest and avoid leaving canes in the field, and to pay particular attention to field sanitation.

Wilcoxon (F.) & Hartzell (A.). **Experiments on Greenhouse Fumigation with β, β′-dichloroethyl ether.**—*Contr. Boyce Thompson Inst.* **10** no. 1 pp. 47–56, 2 figs., 3 refs. Menasha, Wis., 1938.

The following is substantially the authors' summary: β, β′-dichloroethyl ether has been tested as a greenhouse fumigant. It has been shown to control *Aphis rumicis*, L., *Tetranychus telarius*, L., *Taeniothrips simplex*, Morison, and adults of *Trialeurodes vaporariorum*, Westw. Plant tolerance has been tested on 44 species of plants. Among the more susceptible species were rose, peach, castor bean and carnation. Three different methods of volatilisation of the fumigant were studied, and the most promising from a practical standpoint was the use of the pure compound in shallow pans, with vertical porous plates dipping in the liquid to give increased evaporation area. An electric fan was used to maintain circulation of the greenhouse air.

Steiner (L. F.), Fahey (J. E.), Sazama (R. F.) & Rusk (H. W.). **Per Cent Larvicidal Efficiency and Spray Deposits in Relation to Growth, Rainfall and Timing of Cover Sprays on Jonathan.**—*Trans. Ind. hort. Soc. 1937* pp. 88–89. Indianapolis, Ind., 1938.

Experiments were carried out in Indiana in 1937 on the effectiveness of sprays of lead arsenate and of tank-mix nicotine sulphate, bentonite and soy-bean oil against the codling moth [*Cydia pomonella*, L.] on apple [*cf. R.A.E.*, A **26** 652, 732], and the effect on the deposits of growth of the fruit and rainfall. The surface area of the apples doubled during the week after the application of the first cover spray and increased five times in the first four weeks. During the two months preceding harvest, however, it only doubled. One week after the application of the first cover spray, the arsenic and nicotine deposits had decreased from 32·6 and 2·9 mmg. per sq. cm. to 13·0 and 0·8, about 20 and 45 per cent., respectively, having been lost by weathering. From the final cover spray to harvest, the area of the fruit increased about 25 per cent., but arsenic and nicotine deposits decreased from 18·4 and 2·3 to 11·4 and 0·9 mmg. per sq. cm., about 20 and 50 per cent., respectively, having been lost by weathering.

During a period of subnormal rainfall in July, the percentage kill effected per unit of poison by lead arsenate was very low. Nicotine often had a larvicidal efficiency above 85 per cent., which is usually equivalent to nearly perfect control in nature, but this efficiency was never attained by lead arsenate. Rainfall is only one of the many factors that tend to prevent the maintenance of adequate deposits of lead arsenate; and even with deposits that are usually ample, weather conditions that temporarily depress their toxicity may occur. Single applications of nicotine-bentonite more nearly approach the optimum efficiency than lead arsenate, but the usual long interval between the last spray and harvest must be avoided [*cf.* **26** 733].

The efficiency of lead arsenate was low until after the third cover spray. It reached 75 per cent. on 23rd June and then started to drop. There was a spell of dry weather, and though the arsenic deposit was increased in some instances by as much as 50 per cent., the efficiency in some cases was actually falling. Later, it increased again.

Steiner (L. F.), Fahey (J. E.) & Sazama (R. F.). **Recent Developments in Codling Moth Research.**—*Proc. Amer. pomol. Soc.* **53** (1937) pp. 129–141. Washington, D.C., 1938.

An account is given of the various branches of work on the control of the codling moth [*Cydia pomonella*, L.] carried out in Indiana in recent years, much of which has already been noticed [*R.A.E.*, A **23** 600; **24** 182; **25** 20, 232; **26** 320, 652, 732, etc.]. The improvement of spray schedules containing lead arsenate, the replacement of lead arsenate by other substances such as nicotine bentonite, calcium arsenate and thiodiphenylamine (phenothiazine), and measures to supplement spraying, such as the treatment of packing sheds and containers, the use of bait traps, the scraping and banding of the trees, and the clearing of débris from orchards, are dealt with. Lead arsenate, though not the most effective insecticide, is still the only material that can be generally recommended.

Botkin (C. W.) & Hamiel (G. R.). **Spray Residue on Apples in New Mexico.**—*Bull. N. Mex. agric. Exp. Sta.* no. 258, 15 pp., 3 refs. State College, N.M., 1938.

The following is based on the authors' summary of investigations in New Mexico in the period 1927–37 on arsenic residues on apples sprayed with lead arsenate for the control of the codling moth [*Cydia pomonella*, L.]: No significant correlations were observed to have resulted from climatic differences between the different apple-growing regions. The residue depended on the number of applications and the period between the last application and harvest. None of the samples that received one early application of the arsenical, but 15 and 75 per cent., respectively, of the those that received 2 and 3, exceeded the tolerance (0·01 grain arsenic trioxide per lb. fruit). At the end of the spraying season only one, and six weeks later none of four different treatments tested during 1937, in which 2 early lead arsenate sprays were followed by 4 containing no arsenic, gave residues exceeding the tolerance. Cleaning is necessary when more than two early applications of arsenicals are made. The decrease in arsenical residue between the last application and harvest is very variable, depending on rain, the nature of the non-arsenical sprays, the variety of apple and the increase in size of the fruit. Washing with 0·5–1·5 per cent. hydrochloric acid reduced the residue to below tolerance. The fruit should be rinsed with water to prevent possible acid injury. Both cider and vinegar made from uncleaned apples exceeded the food tolerance for arsenic trioxide.

Tompkins (C. M.). **A Mosaic Disease of Turnip.**—*J. agric. Res.* **57** no. 8 pp. 589–602, 4 figs., 19 refs. Washington, D.C., 1938.

A mosaic disease of turnip that is prevalent on Long Island, New York, is described, and its possible relationship to other virus diseases of crucifers is discussed. It is characterised by coarse vein clearing

of the leaves in early stages of infection, followed by conspicuous mottling with raised islands, crinkling, and stunting of the plants.

In experiments, the disease was transmitted from infected turnip plants to healthy seedlings by mechanical inoculation, and readily, under greenhouse conditions at 13–19°C. [55·4–66·2°F.], by *Brevicoryne brassicae*, L., and *Myzus persicae*, Sulz. Non-infective Aphids were fed on recently infected turnip plants for 24–48 hours, and then transferred in groups of about 20 to healthy turnip seedlings, which were sprayed with nicotine sulphate 24 hours later. Healthy seedlings, some infested with non-infective Aphids, served as controls. All the controls remained healthy, whereas the majority of the plants infested with infective examples of *B. brassicae* showed typical symptoms of the disease in 15–17 days, and all those infested with infective examples of *M. persicae* did so in 12–18 days. The disease was transmitted mechanically to 18 species of plants belonging to 6 families, 7 of which were crucifers. Lists are given of these and of 53 species, including several crucifers, that did not become infected.

Snelling (R. O.), Painter (R. H.), Parker (J. H.) & Osborn (W. M.). **Resistance of Sorghums to the Chinch Bug.**—*Tech. Bull. U.S. Dep. Agric.* no. 585, 56 pp., 15 figs., 1 pl., 1 fldg. table, 70 refs. Washington, D.C., 1937.

The data here presented on the possibility of reducing injury to *Sorghum* by *Blissus leucopterus*, Say, by using resistant strains were obtained during a period of 5 years in Oklahoma [*cf. R.A.E.*, A **26** 63] and at intervals during more than 15 years in Kansas. The conditions under which the experiments were carried out and the methods are described at length. The points dealt with in the discussion of the results include the rate of killing of the various varieties of *Sorghum*, the effect of time of planting on injury, inheritance of resistance to it, natural selection as a factor in resistance, and the basis of resistance.

Service and Regulatory Announcements, July-September 1938.—*S.R.A., B.E.P.Q.* no. 136 pp. 75–121. Washington, D.C., U.S. Dep. Agric., 1938.

Administrative Instructions (B.E.P.Q. 475 and 480) describe a method of fumigating onions and tomatos with methyl bromide as a condition of certification for moving by refrigerator car to points in the United States outside regulated areas between 15th June and 15th October under Quarantine no. 48 against the Japanese beetle [*Popillia japonica*, Newm.]. The method is identical with that already noticed for the fumigation of potatoes [*R.A.E.*, A **26** 751].

Other information in this part includes summaries of plant quarantine restrictions issued by Kenya, French Morocco, Malaya, Australia and Colombia, and amendments to summaries already noticed of restrictions issued by Italy, Turkey and New Zealand.

White-fringed Beetle Quarantine (Quarantine No. 72).—*U.S. Dep. Agric. B.E.P.Q.*, Q. 72, 5 pp. Washington, D.C., 1939.

Naupactus leucoloma, Boh., was first discovered in the United States in Florida in the autumn of 1936 [*R.A.E.*, A **25** 700]. The

larvae feed on the roots and tubers of a wide range of plants, and the adults on the leaves and shoots. In view of its feeding habits, the various means by which it can be spread and its parthenogenetic mode of reproduction [**26** 131], it is potentially a serious pest.

Notice is given of a quarantine (effective 15th January 1939) designed to prevent the spread of *N. leucoloma* and a closely allied species of the same genus [*cf.* **26** 580] by prohibiting the movement interstate from regulated areas in Alabama, Florida, Louisiana and Mississippi, at certain times of the year, of certain restricted articles, unless accompanied by a valid inspection certificate.

Gobeil (A. R.). **Notes sur** *Phyllotoma nemorata* **Fallen.**—*Bull. Serv. Ent. Minist. Terres Québec* no. 1 7 pp., 1 graph, 3 refs. Quebec, 1937.

In 1935 and 1936, *Phyllotoma nemorata*, Fall., was abundant on birches in a district in Kamouraska County (Quebec), and caused injury to 75–90 per cent. of the leaves. In 1937, an outbreak of the sawfly occurred extending from Quebec to the Gaspé Peninsula. All species of *Betula*, except *B. lenta*, are subject to attack.

Investigations were carried out in 1937 to determine the date at which the nicotine sulphate spray recommended by Peirson [*R.A.E.*, A **17** 553], of which the concentration is here given as 1 : 800, should be applied in Kamouraska. Between 20th July and 21st September, regular collections of larvae were made, and 2,500 were obtained. Measurements of the width of the head indicated that there are generally only five larval instars in this district, whereas in Maine there are six. A table is given, showing the percentages of larvae in different instars at various dates between 20th July and 7th September. It is suggested that the most favourable time for the application of nicotine sulphate is from 24th July to 2nd August ; after the latter date, more than 50 per cent. of the larvae have entered the third instar.

Gobeil (A. R.). **Dommages causés aux forêts de la Gaspésie par les insectes.**—*Bull. Serv. Ent. Minist. Terres Québec* no. 2, 21 pp., 1 fldg map, 9 refs. Quebec, 1938.

The results are given of investigations into the proportion of spruce attacked or killed by *Diprion polytomum*, Htg., and *Dendroctonus piceaperda*, Hopk., in the northern part of the Gaspé peninsula, carried out in 1937 and 1938 as a result of the calculation (based on rough estimates in southern Gaspé) that about 50 per cent. of spruce in the peninsula had been killed or rendered incapable of survival by these pests [*cf. R.A.E.*, A **25** 512]. Their life-histories and habits are briefly described [*cf.* **13** 190 ; **22** 496 ; **24** 315].

Observations on the condition of trees in six river valleys were made between late June and mid-September in 800 sample plots, each $\frac{1}{4}$-acre in area and situated at intervals of $\frac{1}{4}$ mile along lines, 1–2 miles in length and a mile apart, at right angles to the river. A total length of 200 miles was thus under observation. Living trees were classified into four grades according to the percentage of defoliation, determined visually, and those already killed according to the presence or absence of *D. piceaperda* and secondary Scolytids. At the end of 1938, the results obtained from 25 per cent. of the lines were verified ; information received from other sources was also used.

It was estimated that 46 per cent. (by volume) of the spruce had been killed (35 per cent. by *Dendroctonus* and 11 per cent. by *Diprion*), 21 per cent. had little chance of recovery, and 33 per cent. would probably survive. Spruce represents only 34 per cent. of the total forest volume; the dead or dying trees therefore represent only 22 per cent. of the total wooded area or 27 per cent. of the resinous trees. Tables show the proportion of the species of trees in each locality, the proportion of spruce trees in each locality belonging to each defoliation class and the proportion killed by each species of insect. These data are also shown on a map, which gives the situation and number of stations where samples were taken. It was found that during a severe infestation, young trees are often killed before the older ones; in some cases this may have serious effects on the future of the plantation.

Dendroctonus is responsible for killing about 80 per cent. of the trees, but the outbreak appears to be over. Foci of infestation would be reduced by felling defective or decayed trees, and stripping the bark from felled trees left lying in the forest. The percentage of trees killed by *Diprion* is smaller, but about 40 per cent. of the living trees will probably not survive. The only possibility of control is by means of introduced parasites, particularly *Microplectron fuscipenne*, Zett. [*cf.* **26** 77] and *Exenterus abruptorius*, Thnb. In heavily infested areas clear cutting is recommended, and felling in June or July, when the sawfly is in the egg or early larval stages, would ensure the greatest mortality.

HILDEBRAND (A. A.). **Notes on the Strawberry Root Aphid and the Effects of its Feeding Punctures on Strawberry Roots.**—*Sci. Agric.* **19** no. 2 pp. 95–104, 2 pls, 16 refs. Ottawa, 1938.

In September 1936, the roots and crowns of strawberry plants in experimental plots in Ontario were found to be heavily infested with *Cerosipha* (*Aphis*) *forbesi*, Weed, the distribution and economic importance of which are discussed from the literature. Observations showed that mortality and lack of vigour of the plants were closely correlated with the degree of infestation, but injury by the Aphid bore no direct causal relationship to root rot in spite of the occurrence of this on infested roots. The Aphid was not observed on plants other than cultivated varieties of strawberry.

On 4th May 1937, immature Aphids were present on the leaves, crowns and roots of strawberry. Towards the middle of May, ants were active about the crowns of older plants, and many young and mature stem-mothers were found on roots and rootlets. The Aphids spread and their numbers increased until the latter part of July, after which they gradually decreased. Eggs were found in November, and occurred not only on the petioles and along the veins of the central cluster of green leaves but also on roots several inches deep in the soil. Their presence on the roots, which has not before been recorded, complicates the problem of control, which has hitherto consisted in attempts to destroy the recently-hatched stem-mothers, before they are carried from the aerial parts of the plants to the roots by ants.

A study showed that the Aphid is a phloem feeder, the path of the setae through the hypodermis and underlying tissues to the phloem being intercellular. There is little evidence that the injected saliva

exerts a lethal or irritating effect on plant cells contiguous to the stylet track, and mortality and lack of vigour of infested plants are probably due to the reduction of water supply (with solutes), interference with translocation and disturbances of metabolic equilibria, rather than to direct injury to plant tissues.

FROGGATT (J. L.). **Measures for Control of Coco-nut Tree-hopper (*Sexava* spp.).**—*New Guinea agric. Gaz.* **4** no. 3 pp. 3–6. Rabaul, 1938.

The bionomics of the Tettigoniids of the genus *Sexava* that attack coconut in the Territory of New Guinea [*R.A.E.*, A **24** 201] are briefly recapitulated, and methods of control are discussed. Within three months of starting regular liberations of the Encyrtid, *Leefmansia bicolor*, Wtstn. [**26** 436], this egg parasite was recovered in the field; in some districts it has successfully completed subsequent generations.

In laboratory experiments, 5 per cent. dusts of lead arsenate, calcium arsenate and Paris green, each diluted with slaked lime, gave average percentage mortalities of 80, 87 and 90, respectively, in three days. In some cases, there was evidence that the insects were killed after crawling over a dusted surface by dust on the legs or antennae being ingested when these were cleaned. Non-arsenical dusts, including various preparations of derris (as a pure powder and as total extractives diluted with an inert filler) and pyrethrum, gave poor and variable results, the percentage mortality ranging from 48 to 59 even with the same preparation. Possible alternative methods [**24** 202] include the lighting of fires and destruction of the adults and nymphs driven down by the smoke, and collecting at night, when many more females than males are obtained. The use of adhesive bands [*cf.* **26** 495] is justified only in the early stages of a localised outbreak.

FROGGATT (J. L.). **Weevil Pests of Cocoa.**—*New Guinea agric. Gaz.* **4** no. 3 p. 6. Rabaul, 1938.

Pantorhytes plutus, Oberth., has been collected from cacao in several parts of the Territory of New Guinea, and is a pest in New Britain. The eggs are laid in the bark of both stems and branches, and especially of forks between branches; they are apparently deposited singly, as only one larva occurs in each channel. The larvae tunnel along the soft woody tissue just below the bark, which is ultimately killed over the infested region, leaving a ragged opening and seriously affecting the branch attacked. The adults feed mainly on the bark, but also on the leaves. Spraying with lead arsenate considerably reduced infestation by them. Paradichlorobenzene introduced into the channels failed to kill the larvae; the gum blocking the channel hindered sublimation and prevented the passage of the fumes.

COTTIER (W.). **Citrus Pests: (4) Black Aphis and Mealy Bugs.**—*N. Z. J. Agric.* **57** no. 4 pp. 332–333, 3 figs. Wellington [N.Z.], 1938.

Brief descriptions are given of *Pseudococcus adonidum*, L., *P. maritimus*, Ehrh., and the alate and apterous forms of *Aphis tavaresi*,

Del G., together with notes on their bionomics and the injury they cause. In New Zealand, small colonies of the Aphid may be found on *Citrus* during the winter. A spray of nicotine sulphate (1 : 800) with soft soap (3 lb. per 100 gals.) is recommended for control. The mealybugs may also be found on *Citrus* during the winter in all stages of development. A spray of 1 part summer oil and 80 parts water with nicotine sulphate (1 : 800) or nicotine sulphate (1 : 600–800) with a good wetting agent is recommended.

HELY (P. C.). **The Interaction of Sprays commonly used on *Citrus* Trees in Coastal Districts.**—*Agric. Gaz. N.S.W.* **49** pt. 10 pp. 545–548, 1 fig. Sydney, 1938.

Tests on the reactions of sprays with the residues left on *Citrus* trees by previous sprays were carried out on orange in the coastal area of New South Wales during 1934–37, and supplemented by observations in orchards.

Bordeaux mixture leaves a very persistent residue. When it is followed by red oil (1 : 40) even as much as 3 months later, heavy defoliation and fruit fall may result, but the addition of 3½ lb. sodium carbonate to 40 gals. diluted red-oil spray practically removes the danger of injury. Bordeaux mixture (6 : 4 : 80) with red oil (1 : 40) has not caused injury, but the oil was rendered ineffective against Coccids. The fungicide is compatible with white oil, but the combination is not recommended. It should not be followed by white oil with sodium carbonate, as heavy leaf fall may result, but may safely be followed by white oil alone, within a few hours. Lime-sulphur may be applied a week after Bordeaux mixture to young vigorous trees in spring, but may cause leaf fall and fruit scorching in summer. The injury usual after spraying with sodium carbonate is intensified when Bordeaux residues are present. A wash of sodium carbonate and resin is usually safe after an interval of a month, but fumigation after as long as 6 months may cause severe defoliation.

Lime-sulphur may safely be applied in winter at strengths of 1 : 8–15, and in spring and summer at 1 : 30–50, although leaf fall and scorching of fruit may be caused in hot weather during January–March. It may be followed safely by Bordeaux or Burgundy mixture. Red oil (1 : 40) applied up to 2 months after lime-sulphur may scorch the fruit in hot weather, but the addition of sodium carbonate reduces the tendency to injury. Neither the latter nor white oil is likely to cause injury after lime-sulphur, but white oil should be applied only after an interval of 2–3 weeks and not in very hot weather.

Red oil should be used only between January and April, and not during great heat or on trees suffering from drought. Complete emulsification, which is facilitated by the addition of sodium carbonate, is essential. Both Bordeaux mixture and lime-sulphur caused injury when they followed red oil, but none after red oil with sodium carbonate, although the lime-sulphur did not spread well.

Though its use in winter on *Citrus* trees is not advisable, white oil is a safe spray under many conditions and in combination with all the common sprays, except during hot weather, when it should not be used with sulphur compounds. It may safely be followed by Bordeaux mixture, with an oil spreader, by colloidal sulphur and by lime-sulphur, although the latter may cause some injury owing to poor

spreading. Sprays of sodium carbonate and resin applied 3 months after white oil caused leaf drop, but the reverse order of application is safe.

Red oil following Burgundy mixture causes fruit scorching and leaf fall, but the injury to the fruit may be reduced by the addition of sodium carbonate to the oil. When Burgundy mixture was followed after 6 weeks by lime-sulphur, leaf fall and severe scorching of fruit resulted ; and the residues from previous spraying with Burgundy mixture accentuate the leaf fall normal after sprays containing sodium carbonate.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **49** pt. 10 pp. 549–552, 6 figs. Sydney, 1938.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **26** 755] includes notes on the parasitism of Lepidopterous larvae, especially cutworms, by *Lissopimpla semipunctata*, Kby., and *Echthromorpha intricatoria*, F., and on the technique of using combined sprays against apple pests in the orchard. A combined spray of 1 pint nicotine sulphate, 1 lb. lead arsenate powder and 1 lb. calcium caseinate in 75 gals. water is recommended for use on cherries, while the fruits are very small, against *Myzus cerasi*, F., and *Caliroa limacina*, Retz.

Soraci (F. A.). **Occurrence of a Sawfly** (*Acantholyda erythrocephala* **L.) in New Jersey.**—*J. N. Y. ent. Soc.* **46** no. 3 p. 326, 1 ref. New York, N.Y., 1938.

Adults reared from larvae that had defoliated several acres of 5–12 ft. high red and Austrian pines (*Pinus resinosa* and *P. nigra*) in a nursery at Oakland, New Jersey, in mid-June 1937, and from others infesting a 40 ft. white pine (*P. strobus*) at Morristown, were identified as *Acantholyda erythrocephala*, L. This sawfly had been taken in the United States only once before [*cf. R.A.E.*, A **14** 641].

On 1st June 1938, when the larvae were feeding on the needles of the pines at Oakland, a spray of lead arsenate applied from an autogiro killed practically all of them. The sawfly was, however, subsequently taken in many parts of the State, though no other serious infestation was found.

Middlekauff (W. W.). **Occurrence of a European Sawfly** *Acantholyda erythrocephala* **(L.) in New York State.**—*J. N. Y. ent. Soc.* **46** no. 4 p. 438, 2 refs. New York, N.Y., 1938.

Adults of *Acantholyda erythrocephala*, L., were found flying near Austrian pines (*Pinus nigra*) at Scarsdale, New York, in April 1938.

Soraci (F. A.). **Distribution of the Sawfly** (*Acantholyda erythrocephala* **L.) in New Jersey.**—*J. N. Y. ent. Soc.* **46** no. 4 p. 444, 1 ref. New York, N.Y., 1938.

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